Dominion Energy

North Anna Power Station

Radiological Environmental Monitoring Program

January 1, 2017 to December 31, 2017

Prepared by

Dominion Energy, North Anna Power Station

Annual Radiological Environmental Operating Report

North Anna Power Station

January 1, 2017 to December 31, 2017

Prepared by: _____

Bradley T. Pleasants, Jr.
Supervisor Radiological Analysis and Instrumentation
Dominion Energy North Anna Power Station

Reviewed by: _____

Barbara J. Thompson
Superintendent Health Physics Technical Services
Dominion Energy North Anna Power Station

Approved by: _____

George R. Simmons
Manager Radiological Protection and Chemistry
Dominion Energy North Anna Power Station

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1. EXECUTIVE SUMMARY

This document is a detailed report of the 2017 North Anna Nuclear Power Station Radiological Environmental Monitoring Program (REMP). It is submitted in accordance with North Anna Unit 1 and 2 Technical Specification 5.6.2 and North Anna Independent Spent Fuel Storage Installation (ISFSI) Technical Specification 5.5.2. Radioactivity levels from January 1 through December 31, 2017, in water, silt, shoreline sediment, milk, aquatic biota, food products, vegetation, and direct exposure pathways have been analyzed, evaluated and summarized. The REMP is designed to confirm that radiological effluent releases are As Low As Reasonably Achievable (ALARA), no undue environmental effects occur, and the health and safety of the public are protected. The program also detects any unexpected environmental processes that could allow radiation accumulations in the environment or food pathway chains.

Radiation and radioactivity in the environment are monitored within a 25-mile radius of the station. North Anna Power Station (NAPS) personnel collect a variety of samples within this area. A number of sampling locations for each medium are selected using available meteorological, land use, and water use data. Two types of samples are obtained. Control samples are collected from areas that are beyond the measurable influence of North Anna Power Station (NAPS) or any other nuclear facility. These samples are used as reference data. Normal background radiation levels, or radiation present due to causes other than North Anna Power Station (NAPS), can be compared to the environment surrounding the station. Indicator samples are the second sample type obtained. These samples show how much radiation is contributed to the environment by the station. Indicator samples are taken from areas close to the station where any station contribution will be at the highest concentration.

Prior to station operation, samples were collected and analyzed to determine the amount of radioactivity present in the area. The resulting values are used as a "pre-operational baseline." Analysis results from the indicator samples are compared to both current control sample values and the pre-operational baseline to determine if changes in radioactivity levels are attributable to station operations, or causes such as the Chernobyl accident, Fukushima Daiichi or natural variation.

Mirion Technologies provided thermoluminescent dosimetry (TLD) services and Teledyne Brown Engineering Environmental Services provided radioanalytical services. Participation in an Interlaboratory Comparison Program provides an independent check of sample measurement precision and accuracy. Typically, radioactivity levels in the environment are so low that analysis values frequently fall below the minimum detection limits of state-of-the-art measurement methods. Because of this, the Nuclear Regulatory Commission (NRC) requires equipment used for radiological environmental monitoring be able to detect specified minimum Lower Limits of Detection (LLDs). This ensures that analyses are as accurate as possible. The NRC also mandates a reporting level for certain radionuclides. Licensed nuclear facilities must report the radionuclide activities in those environmental samples that are equal to or greater than the specified reporting level. Environmental radiation levels are sometimes referred to as a percent of the reporting level.

Analytical results are reported for all possible radiation exposure pathways to man. These pathways include airborne, water, aquatic, terrestrial, and direct radiation exposure. The airborne exposure pathway includes radioactive airborne iodine and particulates, and precipitation. The 2017 airborne results were similar to previous years. Fallout or natural radioactivity levels remained at levels consistent with past years' results.

Water and aquatic exposure pathway samples include precipitation, surface, river and well water, silt and shoreline sediments, and fish. The average tritium activity in surface water for 2017 was 5243 pCi/liter. No other plant related isotopes were reported in any surface or river water. River water collected from the North

Anna River, 5.8 miles downstream of the site had an average tritium level of 4570 pCi/liter. No plant related isotopes were detected in quarterly precipitation samples. Silt samples indicated the presence of naturally occurring potassium-40 and thorium and uranium decay daughters at levels consistent with the natural background. No plant related isotope was identified in any sample. Shoreline soil, which may provide a direct exposure pathway, indicated the presence of potassium-40 and thorium and uranium decay daughters also at levels consistent with natural levels. No plant related isotope was detected in the indicator or control locations in shoreline soil. No plant related isotope was detected in fish samples from either Lake Anna or the control location, Lake Orange.

Soil samples, which are collected every three years from twelve stations, were not collected in 2017.

The terrestrial exposure pathway includes milk and food/vegetation products. No plant related radioisotope was detected in any milk samples. Naturally occurring beryllium-7, potassium-40 and radionuclides associated with the uranium and thorium series were detected at environmental levels consistent with historical data. No plant related isotope was detected in any vegetation sample. Low levels of Cs-137 have been detected intermittently in past years due to weapons testing, Chernobyl, and Fukushima.

The direct exposure pathway measures environmental radiation doses by use of thermoluminescent dosimeters (TLDs). TLD results have remained essentially constant over the years.

During 2017, as in previous years, operation of the North Anna Power Station and the Independent Spent Fuel Storage Installation (ISFSI) created no adverse environmental effects or health hazards. The maximum total body dose calculated for a hypothetical individual at the station site boundary due to liquid and gaseous effluents released from the station during 2017 was 0.628 millirem. For reference, this dose may be compared to the 620 millirem average annual exposure to every person in the United States from natural and man-made sources. Natural background sources in the environment provide approximately 50% of radiation exposure to man, while medical uses provide approximately 48%. By comparison, nuclear power contributes less than 0.1%. These results demonstrate not only compliance with federal and state regulations but also demonstrate the adequacy of radioactive effluent control at North Anna Power Station.

2. PROGRAM DESCRIPTION

2.1 Introduction

This report documents the 2017 North Anna Power Station operational Radiological Environmental Monitoring Program (REMP).

The North Anna Power Station of Virginia Electric and Power Company (Dominion Energy) is located on Lake Anna in Mineral, Virginia, approximately 35 miles southwest of Fredericksburg, Virginia. The site consists of two units, each with a pressurized water reactor (PWR) nuclear steam supply system and turbine generator furnished by Westinghouse Electric Corporation. Each unit has a gross electrical output of 1029 megawatts electric (MWe). Unit 1 achieved commercial operation on June 6, 1978 and Unit 2 on December 14, 1980. An independent spent fuel storage facility was licensed for dry cask storage of spent fuel in 1998.

The United States Nuclear Regulatory Commission (USNRC) regulations require that nuclear power plants be designed, constructed, and operated to keep levels of radioactive material in effluents to unrestricted areas as low as reasonably achievable (ALARA). To ensure these criteria are met, the operating license for North Anna Power Station includes Technical Specifications which address the release of radioactive effluents. In-plant monitoring is used to ensure release limits are not exceeded. As a precaution against unexpected or undefined environmental processes which might allow undue accumulation of radioactivity in the environment, a program for monitoring the plant environs is also included in the North Anna Power Station Offsite Dose Calculation Manual (ODCM).

North Anna Power Station is responsible for collecting the various indicator and control environmental samples. Mirion Technologies is utilized for processing the TLDs. Teledyne Brown Engineering Environmental Services (TBE) is utilized for sample analyses. The results of the analyses are used to determine if changes in radioactivity levels may be attributable to station operations. Measured values are compared with control levels, which vary with time due to external events, such as cosmic ray bombardment, nuclear weapons test fallout and seasonal variations of naturally occurring radioisotopes. Data collected prior to station operation is used to indicate the degree of natural variation to be expected. The pre-operational data is compared with data collected during the operational phase to assist in evaluating any radiological impact of station operation.

Occasionally samples of environmental media show the presence of man-made isotopes. As a method of referencing the measured radionuclide concentrations in the sample media to a dose consequence to man, the data is compared to the reporting level concentrations listed in North Anna's ODCM. These concentrations are based upon the annual dose commitment recommended by 10CFR50, Appendix I, to meet the criterion of "As Low As Is Reasonably Achievable".

This report documents the results of the Radiological Environmental Monitoring Program for 2017 and satisfies the following objectives of the program:

- To provide measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of the maximum exposed member of the public resulting from station operations.

- To supplement the radiological effluent monitoring program by verifying that radioactive effluents are within allowable limits.

- To identify changes in radioactivity in the environment.
- To verify that station operations have no detrimental effect on the health and safety of the public.

2.2 Sampling and Analysis Program

Table 2-1 summarizes the 2017 sampling program for North Anna Power Station. All samples listed in Table 2-1 are taken at indicator locations except those labeled "control." The North Anna Radiological Monitoring Locations maps denote sample locations for North Anna Power Station. The locations are color coded to designate sample types. Table 2-2 summarizes the analysis program conducted by TBE for North Anna Power Station during the year 2017.

TABLE 2-1

North Anna Power Station – 2017

RADIOLOGICAL SAMPLING STATION

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Environmental	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Quarterly & Annually	
Dosimetry (TLD)	Fredericks Hall	02	5.30	SSW	203°	Quarterly & Annually	
	Mineral, Va	03	7.10	WSW	243°	Quarterly & Annually	
	Wares Crossroads	04	5.10	WNW	287°	Quarterly & Annually	
	Route 752	05	4.20	NNE	20°	Quarterly & Annually	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Quarterly & Annually	
	Levy, VA	06	4.70	ESE	115°	Quarterly & Annually	
	Bumpass, VA	07	7.30	SSE	167°	Quarterly & Annually	
	End of Route 685	21	1.00	WNW	301°	Quarterly & Annually	
	Route 700	22	1.00	WSW	242°	Quarterly & Annually	
	"Aspen Hills"	23	0.93	SSE	158°	Quarterly & Annually	
	Orange, VA	24	22.00	NW	325°	Quarterly & Annually	Control
	Bearing Cooling Tower	N-1/33	0.06	N	10°	Quarterly	
	Sturgeon's Creek Marina	N-2/34	2.04	N	11°	Quarterly	
	Parking Lot "C" (on-site)	NNE-3/35	0.24	NNE	32°	Quarterly	
	Good Hope Church	NNE-4/36	3.77	NNE	25°	Quarterly	
	Parking Lot "B"	NE-5/37	0.20	NE	42°	Quarterly	
	Lake Anna Marina (Bogg's Dr)	NE-6/38	1.46	NE	34°	Quarterly	
	Weather Tower Fence	ENE-7/39	0.36	ENE	74°	Quarterly	
	Route 689	ENE-8/40	2.43	ENE	65°	Quarterly	
	Near Training Facility	E-9/41	0.30	E	91°	Quarterly	
	"Morning Glory Hill"	E-10/42	2.85	E	93°	Quarterly	
	Island Dike	ESE-11/43	0.12	ESE	103°	Quarterly	
	Route 622	ESE-12/44	4.70	ESE	115°	Quarterly	
	DVP Biology Lab	SE-13/45	0.64	SE	138°	Quarterly	
	Route 701 (Dam Entrance)	SE-14/46	5.88	SE	137°	Quarterly	
	"Aspen Hills"	SSE-15/47	0.93	SSE	158°	Quarterly	
	Elk Creek	SSE-16/48	2.33	SSE	165°	Quarterly	
	NAPS Access Rd.	S-17/49	0.36	S	173°	Quarterly	

TABLE 2-1

North Anna Power Station – 2017

RADIOLOGICAL SAMPLING STATION

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Environmental	Elk Creek Church	S-18/50	1.55	S	178°	Quarterly	
Thermoluminescent	NAPS Access Rd.	SSW-19/51	0.24	SSW	197°	Quarterly	
Dosimetry (TLD)	Route 618	SSW-20/52	5.30	SSW	205°	Quarterly	
	500kv Tower	SW-21/53	0.60	SW	218°	Quarterly	
	Route 700	SW-22/54	3.96	SW	232°	Quarterly	
	NAPS Radio Tower	WSW-23/55	0.38	WSW	237°	Quarterly	
	Route 700 (Exclusion Boundary)	WSW-24/56	1.00	WSW	242°	Quarterly	
	South Gate Switchyard	W-25/57	0.32	W	279°	Quarterly	
	Route 685	W-26/58	1.55	W	274°	Quarterly	
	End of Route 685	WNW-27/59	1.00	WNW	301°	Quarterly	
	Route 685	WNW-28/60	1.40	WNW	303°	Quarterly	
	North Gate - Laydown Area	NW-29/61	0.52	NW	321°	Quarterly	
	Lake Anna Campground	NW-30/62	2.54	NW	319°	Quarterly	
	#1/#2 Intake	NNW-31/63	0.07	NNW	349°	Quarterly	
	Route 208	NNW-32/64	2.21	NNW	344°	Quarterly	
	Bumpass Post Office	C-1/2	7.30	SSE	167°	Quarterly	
	Orange, VA	C-3/4	22.00	NW	325°	Quarterly	Control
	Mineral, VA	C-5/6	7.10	WSW	243°	Quarterly	
	Louisa, VA	C-7/8	11.54	WSW	257°	Quarterly	Control
Airborne Particulate	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Weekly	
and Radioiodine	Biology Lab	01A	0.64	SE	138°	Weekly	
	Fredericks Hall	02	5.30	SSW	203°	Weekly	
	Mineral, VA	03	7.10	WSW	243°	Weekly	
	Wares Crossroads	04	5.10	WNW	287°	Weekly	
	Route 752	05	4.20	NNE	20°	Weekly	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Weekly	
	Levy, VA	06	4.70	ESE	115°	Weekly	
	Bumpass, VA	07	7.30	SSE	167°	Weekly	

TABLE 2-1

North Anna Power Station – 2017

RADIOLOGICAL SAMPLING STATION

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Airborne Particulate and Radioiodine	End of Route 685	21	1.00	WNW	301°	Weekly	
	Route 700	22	1.00	WSW	242°	Weekly	
	"Aspen Hills"	23	0.93	SSE	158°	Weekly	
	Orange, VA	24	22.00	NW	325°	Weekly	Control
Surface Water	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Monthly	
	Lake Anna (upstream) (Route 669 Bridge)	09A	12.90	WNW	295°	Monthly	Control
River Water	North Anna River (downstream)	11	5.80	SE	128°	Monthly	
Ground Water (Well Water)	Biology Lab	01A	0.64	SE	138°	Quarterly	
Precipitation	Biology Lab	01A	0.64	SE	138°	Monthly	
Aquatic Sediment	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
	Lake Anna (upstream) (Route 669 Bridge)	09A	12.90	WNW	295°	Semi-Annually	Control
	North Anna River (downstream)	11	5.80	SE	128°	Semi-Annually	
Shoreline Soil	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
Soil	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Once/3 years	
	Fredericks Hall	02	5.30	SSW	203°	Once/3 years	
	Mineral, VA	03	7.10	WSW	243°	Once/3 years	
	Wares Crossroads	04	5.10	WNW	287°	Once/3 years	

TABLE 2-1

North Anna Power Station – 2017

RADIOLOGICAL SAMPLING STATION

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Soil	Route 752	05	4.20	NNE	20°	Once/3 years	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Once/3 years	
	Levy, VA	06	4.70	ESE	115°	Once/3 years	
	Bumpass, VA	07	7.30	SSE	167°	Once/3 years	
	End of Route 685	21	1.00	WNW	301°	Once/3 years	
	Route 700 (Exclusion Boundary)	22	1.00	WSW	242°	Once/3 years	
	"Aspen Hills"	23	0.93	SSE	158°	Once/3 years	
	Orange, VA	24	22.00	NW	325°	Once/3 years	Control
Milk	Lakeside Dairy	12A	7.50	NW	310°	Monthly	
Fish	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
	Lake Orange	25	16.5	NW	312°	Semi-Annually	Control
Food Products (Vegetation)	Stagecoach Road	14B	1.22	NNE	40°	Monthly if available or at harvest	
	Route 614	15	1.37	SE	133°	Monthly if available or at harvest	
	Route 629/522	16	12.60	NW	314°	Monthly if available or at harvest	Control
	Aspen Hills	23	0.93	SSE	158°	Monthly if available or at harvest	
	"Historic Lane"	26	1.15	S	172°	Monthly if available or at harvest	

TABLE 2-2

North Anna Power Station

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
Thermoluminescent Dosimetry (TLD)				
(84 TLDs)	Quarterly	Gamma Dose	2 mR±2mR	mR/std. Month
(12 TLDs)	Annually	Gamma Dose	2 mR±2mR	mR/std. Month
Airborne Radioiodine	Weekly	I-131	0.07	pCi/m^3
Airborne Particulate	Weekly	Gross Beta	0.01	pCi/m^3
	Quarterly (a)	Gamma Isotopic		pCi/m^3
		Cs-134	0.05	
		Cs-137	0.06	
	2nd Quarter	Sr-89	(b)	pCi/m^3
	Composite	Sr-90	(b)	
Surface Water	Monthly	I-131	1(c)	pCi/L
		Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
		La-140	15	
	Quarterly(a)	Tritium (H-3)	2000	pCi/L
	2nd Quarter	Sr-89	(b)	pCi/L
	Composite	Sr-90	(b)	
River Water	Monthly	I-131	1(c)	pCi/L
		Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	

*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

(a) Quarterly composite of each location's samples are used for the required analysis

(b) There are no required LLDs for Sr-89/90

(c) LLD for non-drinking water is 10 pCi/liter

(d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

TABLE 2-2

North Anna Power Station

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
		La-140	15	
River Water	Quarterly(a)	Tritium (H-3)	2000	pCi/L
	2nd Quarter	Sr-89	(b)	pCi/L
	Composite	Sr-90	(b)	
Ground Water (Well Water)	Quarterly	Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		I-131	10(c)	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
		La-140	15	
	Quarterly(a)	Tritium (H-3)	2000	pCi/L
	2nd Quarter	Sr-89	(b)	pCi/L
		Sr-90	(b)	
Aquatic Sediment	Semi-Annually	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	
	Annually	Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	
Precipitation	Monthly	Gross Beta	4	pCi/L
	Semi-Annual	Gamma Isotopic		pCi/L
	Composite	Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		I-131	(d)	
		Cs-134	15	
		Cs-137	18	
		Ba-140	(d)	
		La-140	(d)	
Shoreline Soil	Semi-Annually	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	

*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

(a) Quarterly composite of each location's samples are used for the required analysis

(b) There are no required LLDs for Sr-89/90

(c) LLD for non-drinking water is 10 pCi/liter

(d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

TABLE 2-2

North Anna Power Station

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
	Annually	Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	
Soil	Once per 3 years	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	
		Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	
Milk	Monthly	I-131	1	pCi/L
	Monthly	Gamma Isotopic		
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
		La-140	15	
	Quarterly	Sr-89	(b)	pCi/L
		Sr-90	(b)	
Fish	Semi-Annually	Gamma Isotopic		pCi/kg (wet)
		Mn-54	130	
		Fe-59	260	
		Co-58	130	
		Co-60	130	
		Zn-65	260	
		Cs-134	130	
		Cs-137	150	
Food Products (Broadleaf Vegetation)	Monthly, if available, or at harvest	Gamma Isotopic		pCi/kg (wet)
		Cs-134	60	
		Cs-137	80	
		I-131	60	

*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

(a) Quarterly composite of each location's samples are used for the required analysis

(b) There are no required LLDs for Sr-89/90

(c) LLD for non-drinking water is 10 pCi/liter

(d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

Legend For The North Anna Power Station
Environmental Monitoring Stations Overview Maps

Map Designation	Environmental Station Identification	Map Designation	Environmental Station Identification
1 (a)	01,NE-5/37	7/8	C-7/8
1A	01A,SE-13/45	1/33	N-1/33
2 (a)	02,SSW-20/52	31/63	NNW-31/63
3 (a)	03,C-5/6	29/61	NW-29/61
4 (a)	04	3/35	NNE-3/35
5 (a)	05	7/39	ENE-7/39
5A (a)	05A,N-2/34	9/41	E-9/41
6 (a)	06,ESE-12/44	11/43	ESE-11/43
7 (a)	07, C-1/2	17/49	S-17/49
8	08-Water, Fish, Sediment,	19/51	SSW-19/51
	Shoreline Soil	21/53	SW-21/53
9A	09A-Water sample, Sediment	23/55	WSW-23/55
11	11-River Water, Sediment		
12A	12A-Milk	25/57	W-25/57
14B	14B-Vegetation	16/48	SSE-16/48
15	15-Vegetation	14/46	SE-14/46
16	16-Vegetation	22/54	SW-22/54
21 (a)	21,WNW-27/59	26/58	W-26/58
22 (a)	22,WSW-24/56	28/60	WNW-28/60
23 (a)	23-SSE-15/47,Vegetation	32/64	NNW-32/64
24 (a)(b)	24,C-3/4	8/40	ENE-8/40
25 (c)	25-Fish	4/36	NNE-4/36
26	26-Vegetation	10/42	E-10/42

(a) Indicates air sample station, annual and quarterly TLD, Triennial soil.
(b) In Orange
(c) In Lake Orange

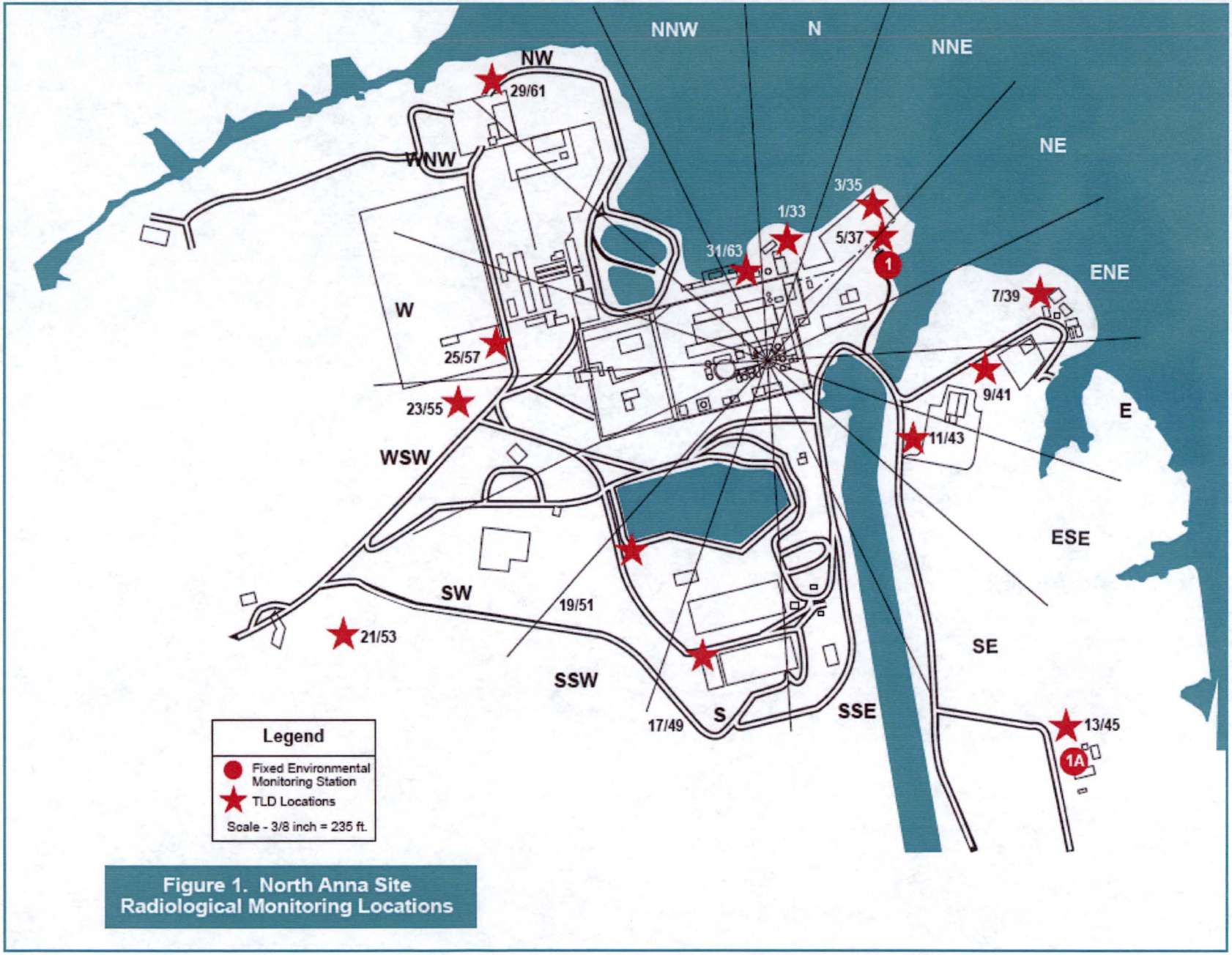
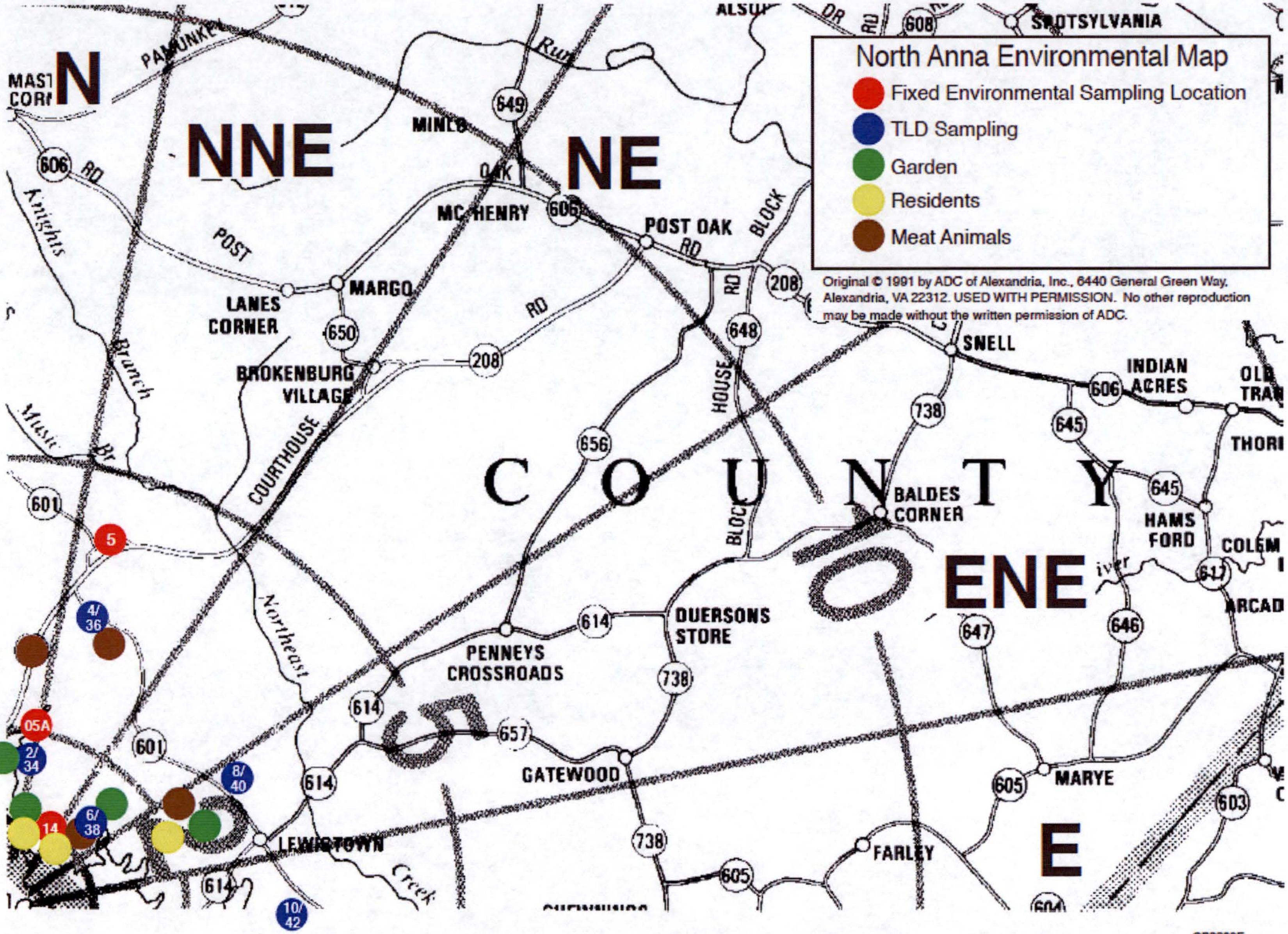


Figure 1. North Anna Site Radiological Monitoring Locations


North Anna Environmental Map
Fixed Environmental Sampling Location
TLD Sampling
Garden
Residents
Meat Animals
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N
NNE
NE
ENE
E
COUNTY
SPOTSYLVANIA
MINEO
OAK
MC HENRY
POST OAK
LANES CORNER
MARGO
BROKENBURG VILLAGE
COURTHOUSE
SNELL
INDIAN ACRES
BALDES CORNER
HAMS FORD
DUERSONS STORE
PENNEYS CROSSROADS
GATEWOOD
MARYE
FARLEY
LEWISTOWN
Knights
Branch
Northeast
Creek
5
4/36
05A
2/34
14
6/38
8/40
10/42

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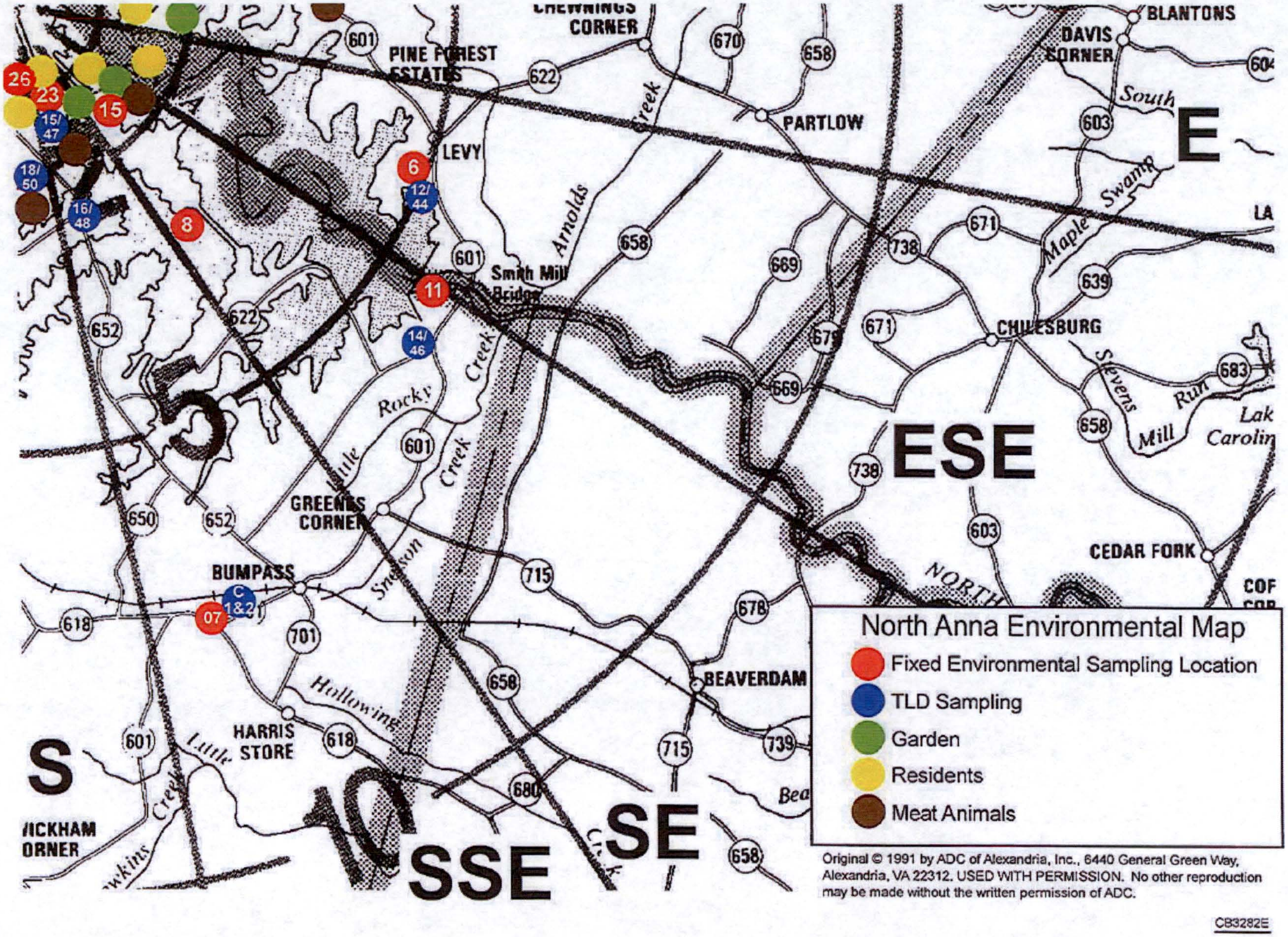
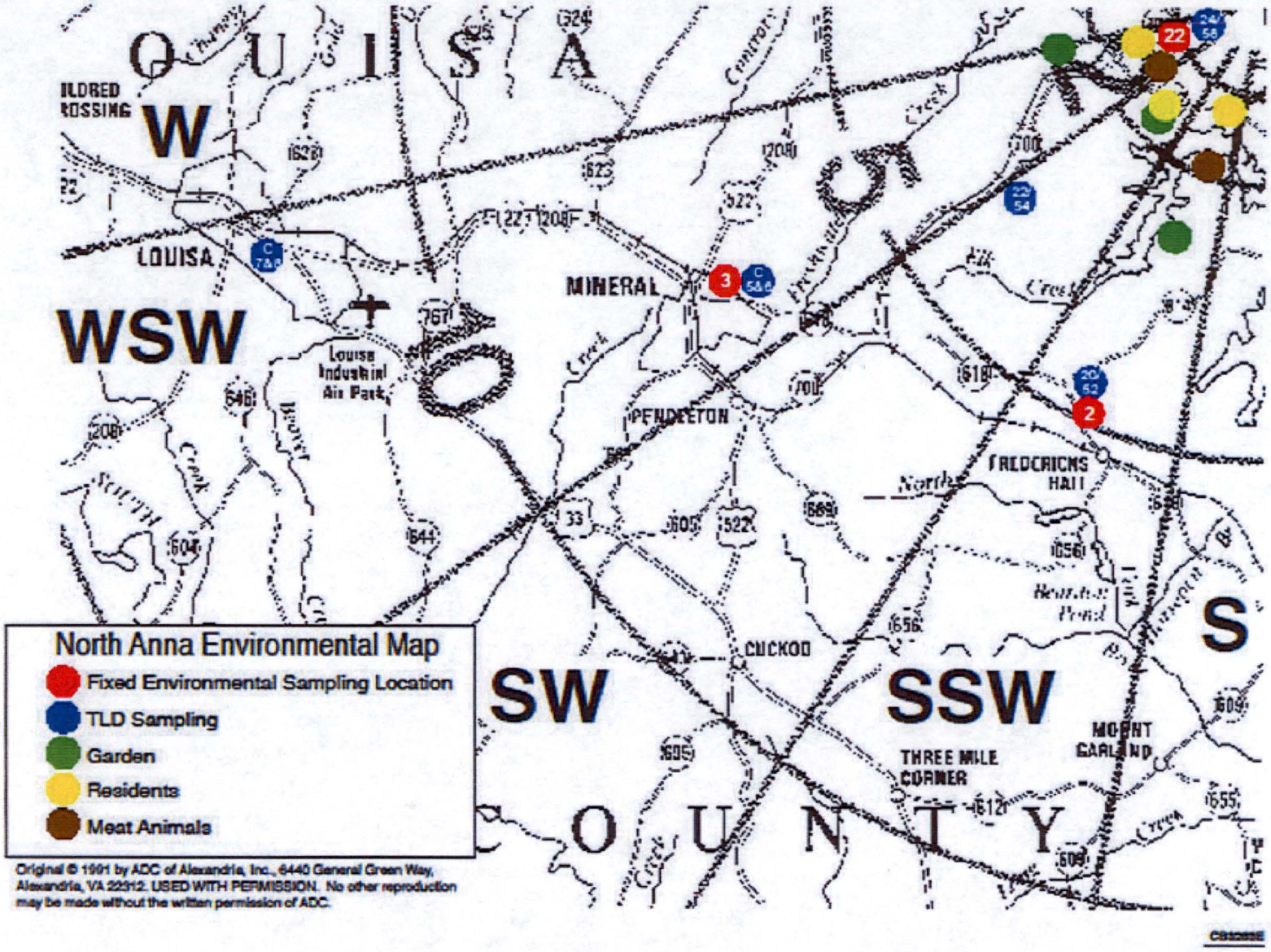

North Anna Environmental Map
Fixed Environmental Sampling Location
TLD Sampling
Garden
Residents
Meat Animals
CHEWNINGS CORNER
PINE FOREST ESTATES
LEVY
PARTLOW
DAVIS CORNER
BLANTONS
Smith Mill Bridge
CHILESBURG
GREENES CORNER
BUMPASS
HARRIS STORE
BEAVERDAM
CEDAR FORK
E
ESE
SE
SSE
S
Arnolds Creek
Rocky Creek
Little Creek
South
Maple Swamp
Stevens Mill Run
Hollowing
Lak Carolin
NORTH
CB3282E


North Anna Environmental Map
Fixed Environmental Sampling Location
TLD Sampling
Garden
Residents
Meat Animals
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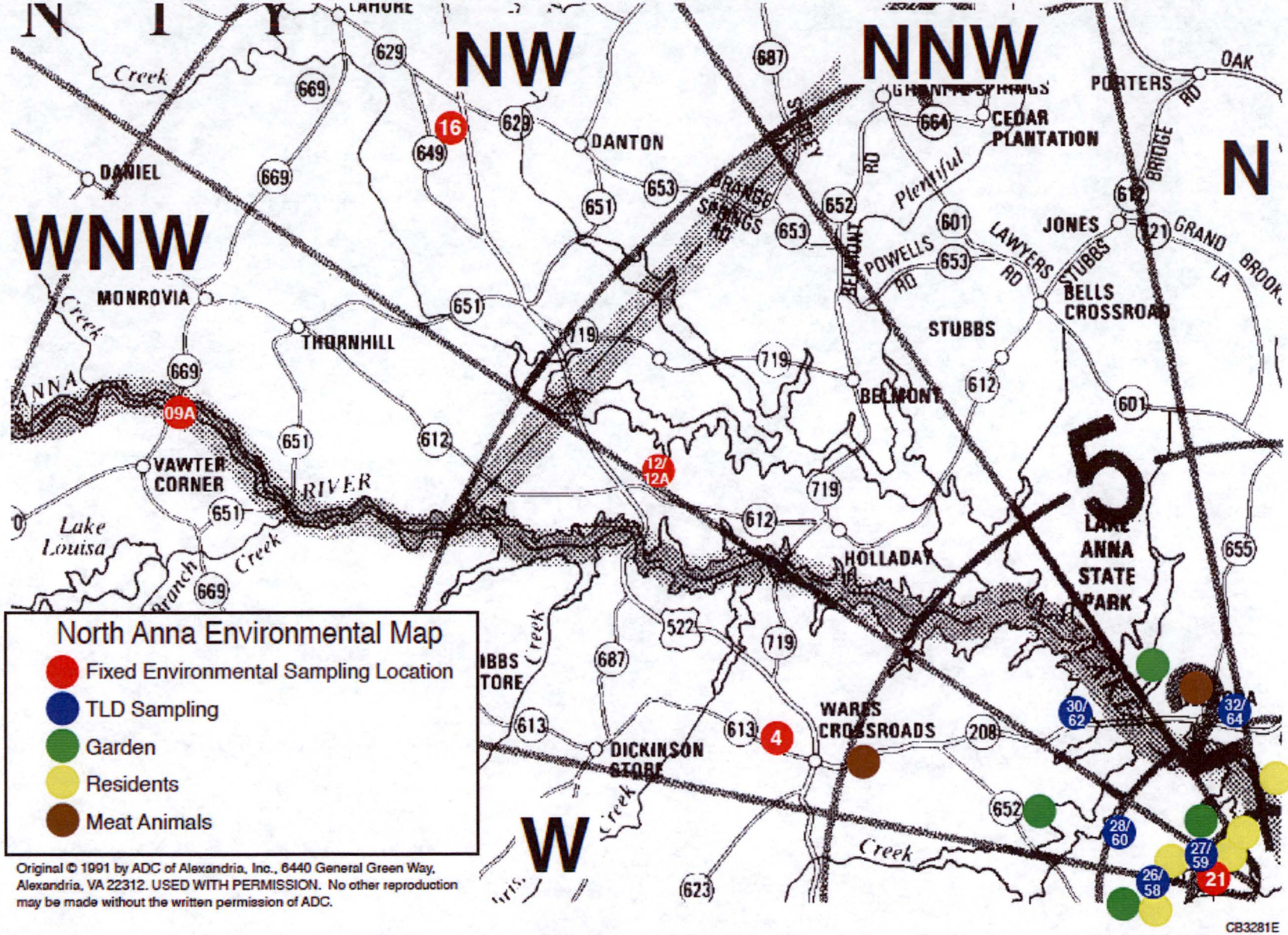
LOUISA
MINERAL
PENDLETON
FREDERICKS HALL
CUCKOO
THREE MILE CORNER
MOUNT GARLAND
Louisa Industrial Air Park
WSW
SW
SSW
S
W


North Anna Environmental Map
Fixed Environmental Sampling Location
TLD Sampling
Garden
Residents
Meat Animals
NW
NNW
WNW
W
N
5
DANIEL
MONROVIA
THORNHILL
VAWTER CORNER
DANTON
CEDAR PLANTATION
PORTERS
OAK
JONES
BELLS CROSSROAD
STUBBS
BELMONT
HOLLADAY
LAKE ANNA STATE PARK
WARES CROSSROADS
DICKINSON STORE
Lake Louisa
RIVER
Creek
16
09A
12/ 12A
4
30/ 62
32/ 64
28/ 60
27/ 59
26/ 58
21
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3. ANALYTICAL RESULTS

3.1 Summary of Results

In accordance with the North Anna Offsite Dose Calculation Manual (ODCM), a summary table of the analytical results has been prepared and is presented in Table 3-1. This data is presented in accordance with the format of the USNRC Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979. The LLD listed value is taken from the ODCM. For radioanalytic analyses, the values listed in the columns indicated as "Mean/Range" include any results above the Minimum Detectable Concentration, MDC. Results are considered true positives when the measured value exceeds both the MDC and the 2Σ error. For TLDs the mean and range include all values.

A more detailed analysis of the data is given in Section 4 where a discussion of the variations in the data explains many aspects that are not evident in the Summary Table because of the basic limitation of data summaries.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Docket No. 50-338/339 2017

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD[1]	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Direct Radiation *(mR.std. Month)* *(Sector TLDs)*	**Gamma Dose**	255	2	4.1 (255/255) **(0.8-9.0)**	25/57	0.32 mi. W	6.9 (8/8) **(4.9-9.0)**	3.2 (15/15)* **(1.7-5.1)**	0
** C3/4, -7/8 used for control locations*									
Direct Radiation *(mR.std. Month)* *(Pre-operational TLDs)*	**Gamma Dose**	31	2	2.7 (16/16) **(1.7-4.1)**	C-1/2	7.30 mi. SSE	3.1 (8/8) **(2.2-4.1)**	3.2 (15/15)* **(1.7-5.1)**	0
** C3/4, -7/8 used for control locations*									
Direct Radiation *(mR.std. Month)* *(Emergency Sector TLDs)*	**Gamma Dose**	40	2	5.1 (40/40) **(2.1-9.1)**	EPSP 09/10	0.37 mi. ENE	7.2 (8/8) **(5.9-9.1)**	3.2 (15/15)* **(1.7-5.1)**	0
** C3/4, -7/8 used for control locations*									
Direct Radiation *(mR.std. Month)* *(Environmental TLDs)*	**Gamma Dose**	48	2	3.2 (44/44) **(1.2-6.1)**	STA-23	0.93 mi. SSE	4.8 (4/4) **(3.7-6.1)**	2.9 (4/4) **(1.6-4.1)**	0
Direct Radiation *(mR.std. Month)* *(Annual TLDs)*	**Gamma Dose**	12	2	3.0 (11/11) **(1.3-4.5)**	STA-23	0.93 mi. SSE	4.5 (1/1) **(4.5)**	3.1 (1/1) **(3.1)**	0
Air Particulate *($1e^{-3}$ pCi/m^3)*	**GR-B**	676	0.01	13.6 (624/624) **(3.6-28.8)**	02	5.30 Mi. SSW	15.7 (52/52) **(7-27.3)**	14.5 (52/52) **(6.5-23.8)**	0
	GAMMA	52							
	BE-7	52	-	133.5 (48/48) **(87.3-201.7)**	02	5.30 mi. SSW	175.3 (4/4) **(147.4-201.7)**	134.2 (4/4) **(111.2-148.7)**	0 0
	Cs-134	52	0.05	**(0/48)**	N/A	N/A	N/A	**(0/4)**	0
	Cs-137	52	0.06	**(0/48)**	N/A	N/A	N/A	**(0/4)**	0
	Sr-89	13	-	**(0/12)**	N/A	N/A	N/A	**(0/1)**	0
	Sr-90	13	-	**(0/12)**	N/A	N/A	N/A	**(0/1)**	0
Air Iodine *($1e^{-3}$ pCi/m^3)*	I-131	676	0.07	**(0/624)**	N/A	N/A	N/A	**(0/52)**	0
Soil* *(pCi/g dry)*	**GAMMA**	0							
	K-40	0	-	N/A	N/A	N/A	N/A	N/A	0
	CS-134	0	150	N/A	N/A	N/A	N/A	N/A	0
	CS-137	0	180	N/A	N/A	N/A	N/A	N/A	0
	Ra-226	0	-	N/A	N/A	N/A	N/A	N/A	0
	Th-228	0	-	N/A	N/A	N/A	N/A	N/A	0

* Soil Samples required triennially. Samples not obtained in 2017
[1] mR/std month for TLDs

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Soil[*] (cont'd) *(pCi/g dry)*	Th-232	0	-	N/A	N/A	N/A	N/A	N/A	0
	Sr-89	0	-	N/A	N/A	N/A	N/A	N/A	0
	Sr-90	0	-	N/A	N/A	N/A	N/A	N/A	0
* Soil Samples required triennially. Samples not obtained in 2017									
Precipitation *(pCi/liter)*	GR-B	12	4	5.3 (12/12) (1.7-18.2)	01A	0.64 mi. SE	5.3 (12/12) (1.7-18.2)	N/A	0
	H-3	12	2000	(0/12)	N/A	N/A	N/A	N/A	0
	GAMMA	2							
	Be-7	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Mn-54	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Fe-59	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Co-58	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Co-60	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Zn-65	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Zr-95	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Nb-95	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	I-131	2	10	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-134	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-137	2	18	(0/2)	N/A	N/A	N/A	N/A	0
	Ba-140	2	-	(0/2)	N/A	N/A	N/A	N/A	0

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Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD[1]	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Precipitation (cont'd) *(pCi/liter)*	La-140	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Th-228	2	-	(0/2)	N/A	N/A	N/A	N/A	0
Milk (pCi/liter)	**GAMMA**	12							
	K-40	12	-	1290 (12/12) (1020 -1457)	12A	7.50 mi. NW	1290 (12/12) (1020-1457)	N/A	0
	I-131	12	1	(0/12)	N/A	N/A	N/A	N/A	0
	Cs-134	12	18	(0/12)	N/A	N/A	N/A	N/A	0
	Cs-137	12	18	(0/12)	N/A	N/A	N/A	N/A	0
	Ba-140	12	60	(0/12)	N/A	N/A	N/A	N/A	0
	La-140	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	SR-89 (quarterly)	4	-	(0/4)	N/A	N/A	N/A	N/A	0
	SR-90 (quarterly)	4	-	(0/4)	N/A	N/A	N/A	N/A	0
Food & Vegetation (pCi/g wet)	**GAMMA**	35							
	BE-7	35	-	1570 (27/28) (377-3200)	26	1.15 mi. S	1758 (7/7) (909-3200)	1640 (7/7) (647-2890)	0
	K-40	35	-	5945 (28/28) (3016-10850)	15	1.37 mi. SE	6523 (7/7) (4485-10420)	5626 (7/7) (4536-8041)	0
	I-131	35	60	(0/28)	N/A	N/A	N/A	(0/7)	0
	Cs-134	35	60	(0/28)	N/A	N/A	N/A	(0/7)	0
	Cs-137	35	80	(0/28)	N/A	N/A	N/A	(0/7)	0
	Ra-226	35	-	871 (3/28) (834-916)	14B	1.22 mi. NNE	916 (1/7) (916)	(0/7)	0
	Ac-228	35	-	293 (6/28) (70-527)	26	1.15 mi. S	357 (2/7) (262-453)	158 (1/7) (158)	0
	Th-228	35	-	64 (6/28) (40-95)	23	.93 mi. SSE	95 (1/7) (95)	88 (3/7) (73-120)	0
	Th-232	35	-	90 (1/28) (90)	26	1.15 mi. S	90 (1/28) (90)	(0/7)	0
Ground Well Water *(pCi/liter)*	H-3	4	2000	(0/4)	N/A	N/A	N/A	N/A	0
	GAMMA	4							
	Mn-54	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Fe-59	4	30	(0/4)	N/A	N/A	N/A	N/A	0

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Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD[1]	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Ground Well Water (cont'd) *(pCi/liter)*	Co-58	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Co-60	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Zn-65	4	30	(0/4)	N/A	N/A	N/A	N/A	0
	Zr-95	4	30	(0/4)	N/A	N/A	N/A	N/A	0
	Nb-95	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	I-131	4	10	(0/4)	N/A	N/A	N/A	N/A	0
	Cs-134	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Cs-137	4	18	(0/4)	N/A	N/A	N/A	N/A	0
	Ba-140	4	60	(0/4)	N/A	N/A	N/A	N/A	0
	La-140	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Sr-89	1	-	(0/1)	N/A	N/A	N/A	N/A	0
	Sr-90	1	-	(0/1)	N/A	N/A	N/A	N/A	0
River Water *(pCi/liter)*	H-3	4	2000	4570 (4/4) (3580-5420)	11	5.80 mi. SE	4570 (4/4) (3580-5420)	(0/4)*	0
	GAMMA	12							
	Mn-54	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Fe-59	12	30	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Co-58	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Co-60	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0

* Results of surface water taken at location 09A used as control value for river water

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Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD[1]	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
River Water (cont'd) *(pCi/liter)*	Zn-65	12	30	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Zr-95	12	30	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Nb-95	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0
	I-131	12	1	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Cs-134	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Cs-137	12	18	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Ba-140	12	60	(0/12)	N/A	N/A	N/A	(0/12)*	0
	La-140	12	15	(0/12)	N/A	N/A	N/A	(0/12)*	0
	Sr-89	1	-	(0/1)	N/A	N/A	N/A	(0/1)*	0
	Sr-90	1	-	(0/1)	N/A	N/A	N/A	(0/1)*	0
Surface Water *(pCi/liter)*	H-3	8	2000	5243 (4/4) (3760-7130)	8	3.37 mi. SSE	5243 (4/4) (3760-7130)	(0/4)	0
	GAMMA	24							
	Mn-54	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Fe-59	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	Co-58	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Co-60	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Zn-65	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	Zr-95	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0

* Results of surface water taken at location 09A used as control value for river water

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Surface Water (cont'd) *(pCi/liter)*	Nb-95	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	I-131	24	1	(0/12)	N/A	N/A	N/A	(0/12)	0
	Cs-134	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Cs-137	24	18	(0/12)	N/A	N/A	N/A	(0/12)	0
	Ba-140	24	60	(0/12)	N/A	N/A	N/A	(0/12)	0
	La-140	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Sr-89	2	-	(0/1)	N/A	N/A	N/A	(0/1)	0
	Sr-90	2	-	(0/1)	N/A	N/A	N/A	(0/1)	0
Sediment Silt (pCi/kg dry)	GAMMA	6							
	K-40	6	-	11823 (4/4) (980-23510)	11	5.80 mi. SE	22265 (2/2) (21020-23510)	26320 (2/2) (21030-31610)	0
	Cs-134	6	150	(0/4)	N/A	N/A	N/A	(0/2)	0
	Cs-137	6	180	(0/4)	N/A	N/A	N/A	(0/2)	0
	Ra-226	6	-	(0/4)	N/A	N/A	N/A	2209 (2/2) (1263-3154)	0
	Th-228	6	-	438 (4/4) (88-868)	11	5.80 mi. SE	726 (2/2) (584-868)	855 (2/2) (718-993)	0
	Th-232	6	-	722 (2/4) (556-889)	11	5.80 mi. SE	722 (2/4) (556-889)	665 (2/2) (544-785)	0
	Sr-89 (Annually)	3	-	(0/2)	N/A	N/A	N/A	(0/1)	0
	Sr-90 (Annually)	3	-	(0/2)	N/A	N/A	N/A	(0/1)	0

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Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD[1]	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Shoreline Soil (pCi/kg dry)	**GAMMA**	2							
	K-40	2	-	1144 (2/2) **(998-1291)**	08	3.37 mi. SSE	1144 (2/2) **(998-1291)**	N/A	0
	Cs-134	2	150	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-137	2	180	(0/2)	N/A	N/A	N/A	N/A	0
	Be-7	2	-	397 (1/2) (397)	08	3.37 mi. SSE	397 (1/2) **(397)**	N/A	0
	Ra-226	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Th-228	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Th-232	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Sr-89 (Annually)	1	-	(0/1)	N/A	N/A	N/A	N/A	0
	Sr-90 (Annually)	1	-	(0/1)	N/A	N/A	N/A	N/A	0
Fish - Other (pCi/g wet)	**GAMMA**	8							
	K-40	8	-	1931 (4/4) **(1331-2204)**	08	3.37 mi. SSE	1931 (4/4) **(1331-2204)**	2162 (4/4) **(1253-3092)**	0
	Mn-54	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Fe-59	8	260	(0/4)	N/A	N/A	N/A	(0/4)	0
	Co-58	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Co-60	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Zn-65	8	260	(0/4)	N/A	N/A	N/A	(0/4)	0
	Cs-134	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Cs-137	8	150	(0/4)	N/A	N/A	N/A	(0/4)	0

3.2 Analytical Results of 2017 REMP Samples

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. The data reported in the following tables are strictly counting statistics. The reported error is two times the standard deviation (2σ) of the net activity. Unless otherwise noted, the overall error (counting, sample size, chemistry, errors, etc.) is estimated to be 2 to 5 times that listed. Results are considered true positives when the measured value exceeds both the MDC and the 2Σ error.

Because of counting statistics, negative values, zeros and numbers below the Minimum Detectable Level (MDL) are statistically valid pieces of data[1]. For clarity of this report only detectable results are presented. TBE's analytical methods meet the Lower Limit of Detection (LLD) requirements given in Table 2 of the USNRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", (November 1979, Revision 1) and the North Anna ODCM.

Data are given according to sample type as indicated below.

1. Gamma Exposure Rate
2. Air Particulates, Gross Beta Radioactivity
3. Air Particulates, Weekly I-131
4. Air Particulates, Quantitative Gamma Spectra
5. Air Particulate Strontium
6. Soil
7. Precipitation
8. Cow Milk
9. Food Products and Vegetation
10. Well Water
11. River Water
12. Surface Water
13. Bottom Sediment/Silt
14. Shoreline Soil
15. Fish

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[1] Analytical results are handled as recommended by HASL *("Reporting of Analytical Results from HASL,"* letter by Leo B. Higginbotham) and NUREG/CR-4007 (Sept. 1984).

TABLE 3-2
QUARTERLY
GAMMA EXPOSURE RATE
(mR/Std. Month) ± 2 Sigma

Station	First Quarter 12/27/2016-3/29/2017	Second Quarter 3/29/2017 6/28/2017	Third Quarter 6/28/2017 9/27/2017	Fourth Quarter 9/27/2017 12/26/2017	Quarterly Average* (+/-) 2 S.D.
N-1	5.0	4.3	3.3	5.8	4.7 (+/-) 1.8
N-33	5.0	4.0	4.2	5.9	
N-2	2.7	2.1	2.1	4.3	2.9 (+/-) 1.0
N-34	4.0	2.1	1.9	4.0	
NNE-3	6.8	6.1	5.8	7.4	6.2 (+/-) 1.9
NNE-35	6.2	5.4	4.4	7.1	
NNE-4	4.9	3.0	3.3	4.3	4.0 (+/-) 2.2
NNE-36	4.3	2.7	3.7	6.0	
NE-5	6.1	4.2	3.3	4.9	4.2 (+/-) 2.0
NE-37	4.8	3.9	3.0	3.7	
NE-6	3.7	3.5	2.3	4.4	3.3 (+/-) 1.7
NE-38	3.5	3.2	1.8	4.1	
ENE-7	5.9	4.3	4.4	6.1	5.7 (+/-) 2.2
ENE-39	6.4	5.2	5.4	7.7	
ENE-8	2.6	2.1	1.1	3.4	2.4 (+/-) 1.6
ENE-40	2.8	(1)	1.7	3.1	
E-9	6.4	4.6	4.0	4.9	4.8 (+/-) 2.0
E-41	4.9	3.8	3.5	5.9	
E-10	4.3	3.2	2.5	5.4	4.0 (+/-) 1.0
E-42	4.7	3.3	3.3	5.1	
ESE-11	4.1	3.2	3.3	4.9	3.9 (+/-) 1.9
ESE-43	5.0	3.4	2.4	4.6	
ESE-12	4.9	4.5	3.3	5.8	4.5 (+/-) 1.6
ESE-44	4.3	4.4	3.5	4.9	
SE-13	3.9	3.8	3.2	4.6	3.9 (+/-) 1.2
SE-45	4.0	3.2	3.7	4.9	
SE-14	6.7	5.2	4.5	6.6	6.1 (+/-) 2.1
SE-46	6.8	5.9	5.2	7.7	
SSE-15	5.0	3.6	4.3	5.8	4.5 (+/-) 2.1
SSE-47	4.3	3.7	3.1	6.0	
SSE-16	2.7	2.1	1.6	3.1	2.5 (+/-) 1.8
SSE-48	2.7	2.0	1.5	4.1	
S-17	5.1	4.6	3.5	6.6	4.5 (+/-) 2.4
S-49	5.1	3.3	3.0	5.1	

(1) TLD not collected.
*Average of collocated TLDs

TABLE 3-2
QUARTERLY
GAMMA EXPOSURE RATE
(mR/Std. Month) ± 2 Sigma

Station	First Quarter 12/27/2016-3/29/2017	Second Quarter 3/29/2017 6/28/2017	Third Quarter 6/28/2017 9/27/2017	Fourth Quarter 9/27/2017 12/26/2017	Quarterly Average* (+/-) 2 S.D.
S-18	1.9	2.1	1.5	2.7	1.9 (+/-) 0.5
S-50	2.2	1.6	0.9	2.1	
SSW-19	6.1	5.6	5.2	5.1	5.7 (+/-) 1.6
SSW-51	6.0	5.2	4.8	7.3	
SSW-20	2.5	1.6	1.6	2.2	1.9 (+/-) 1.1
SSW-52	2.3	1.4	1.1	2.5	
SW-21	4.3	3.7	3.1	4.6	4.0 (+/-) 0.7
SW-53	4.2	4.0	2.9	4.9	
SW-22	4.4	3.9	3.9	5.4	4.3 (+/-) 1.5
SW-54	4.6	3.3	3.5	5.1	
WSW-23	4.2	3.4	4.2	5.1	4.4 (+/-) 1.8
WSW-55	5.3	3.2	3.8	5.7	
WSW-24	4.0	4.0	3.0	4.9	3.9 (+/-) 1.3
WSW-56	4.5	3.3	3.2	4.1	
W-25	9.0	5.9	4.9	7.2	6.9 (+/-) 2.4
W-57	7.0	6.7	6.8	7.8	
W-26	3.5	2.3	2.1	6.2	3.0 (+/-) 2.9
W-58	2.6	2.8	1.5	3.3	
WNW-27	3.2	2.7	3.6	3.8	3.3 (+/-) 1.7
WNW-59	4.5	2.6	1.9	4.0	
WNW-28	2.9	1.8	2.3	4.3	2.8 (+/-) 2.1
WNW-60	3.9	1.9	1.7	3.9	
NW-29	8.2	5.4	6.5	6.0	6.6 (+/-) 1.1
NW-61	6.8	6.9	5.1	7.6	
NW-30	3.1	1.6	0.9	2.4	1.9 (+/-) 1.8
NW-62	2.1	1.3	0.8	2.9	
NNW-31	3.6	3.5	2.1	4.6	3.5 (+/-) 1.8
NNW-63	3.4	4.1	2.1	4.2	
NNW-32	4.9	2.9	3.2	3.9	3.6 (+/-) 2.0
NNW-64	3.8	2.7	2.3	4.9	
				Mean	4.1 (+/-) 1.0

*Average of collocated TLDs

TABLE 3-2
QUARTERLY
GAMMA EXPOSURE RATE
(mR/Std. Month) ± 2 Sigma

Station	First Quarter 12/27/2016-3/29/2017	Second Quarter 3/29/2017 6/28/2017	Third Quarter 6/28/2017 9/27/2017	Fourth Quarter 9/27/2017 12/26/2017	Quarterly Average* (+/-) 2 S.D.
C-1	4.0	2.2	2.6	3.2	3.1 (+/-) 1.4
C-2	3.0	3.0	2.3	4.1	
C-3**	3.3	2.5	1.8	3.8	2.7 (+/-) 1.8
C-4**	3.0	1.9	1.7	3.9	
C-5	2.1	1.7	1.8	2.5	2.2 (+/-) 1.0
C-6	3.1	1.7	2.0	2.7	
C-7**	(1)	3.1	2.1	4.0	3.7 (+/-) 2.1
C-8**	5.1	4.2	2.8	4.5	
				Indicator Mean	2.6 (+/-) 0.6
				Control Mean	3.2 (+/-) 0.5
EPSA-01***	4.6	3.8	3.8	5.9	4.5 (+/-) 1.0
EPSA-02***	5.1	3.3	3.9	5.7	
EPSF-03***	4.2	7.3	2.3	5.8	4.5 (+/-) 3.2
EPSF-04***	4.4	4.0	2.7	5.0	
EPSR-05***	5.7	4.7	3.5	7.4	5.4 (+/-) 2.8
EPSR-06***	5.8	4.8	4.0	7.1	
EPSJ-07***	4.6	4.6	2.5	3.2	3.8 (+/-) 1.1
EPSJ-08***	4.7	3.3	2.1	5.1	
EPSP-09***	7.2	5.9	6.3	7.8	7.2 (+/-) 2.4
EPSP-10***	9.1	6.7	6.1	8.6	
				Mean	5.1 (+/-) 2.0

(1) TLD not collected
* Average of collocated TLDs.
** Control Location
***Emergency Plan TLDs.

TABLE 3-2
QUARTERLY
GAMMA EXPOSURE RATE
(mR/Std. Month) ± 2 Sigma

Station	First Quarter 12/27/2016- 3/29/2017	Second Quarter 3/29/2017 6/28/2017	Third Quarter 6/28/2017 9/27/2017	Fourth Quarter 9/27/2017 12/26/2017	Quarterly Average* (+/-) 2 S.D.	Annual TLD
STA-01	4.8	3.7	2.5	5.5	4.1 (+/-) 2.6	3.3
STA-02	2.1	2.1	1.8	2.3	2.1 (+/-) 0.4	1.6
STA-03	2.3	1.5	1.6	2.8	2.1 (+/-) 1.2	1.3
STA-04	2.6	1.8	1.2	3.7	2.3 (+/-) 2.2	2.5
STA-05	3.3	2.5	1.7	3.9	2.9 (+/-) 1.9	3.1
STA-05A	2.5	2.6	1.7	3.3	2.5 (+/-) 1.3	2.6
STA-06	4.4	4.7	3.5	5.3	4.5 (+/-) 1.5	3.9
STA-07	3.2	3.0	2.8	3.6	3.2 (+/-) 0.7	3.1
STA-21	3.4	2.7	2.1	3.8	3.0 (+/-) 1.5	3.1
STA-22	4.1	4.3	3.2	4.1	3.9 (+/-) 1.0	3.7
STA-23	5.2	3.7	4.1	6.1	4.8 (+/-) 2.2	4.5
STA-24**	3.5	2.5	1.6	4.1	2.9 (+/-) 2.2	3.1
				Mean Indicator Locations	3.2 (+/-) 1.4	3.0 (+/-) 1.9

* Average of collocated TLDs.
** Control

TABLE 3-3
AIR PARTICULATES
GROSS BETA RADIOACTIVITY
(10^{-3} pCi/m^3)

LOCATIONS

PERIOD ENDING	01	(+/-)	02	(+/-)	03	(+/-)	04	(+/-)	05	(+/-)	06	(+/-)	07	(+/-)	21	(+/-)
01/04/17	11.20	2.190	11.20	2.210	10.70	2.240	12.60	2.310	9.520	2.130	8.640	2.060	10.80	2.190	10.60	2.200
01/11/17	11.20	2.460	13.80	2.620	14.50	2.660	12.90	2.570	12.90	2.570	7.630	2.240	12.20	2.520	10.40	2.420
01/17/17	12.50	2.880	11.80	2.830	11.50	2.810	15.50	3.050	11.50	2.810	11.00	2.780	10.60	2.750	12.60	2.880
01/24/17	8.510	2.320	7.020	2.220	7.500	2.250	7.330	2.240	9.590	2.390	7.950	2.280	9.200	2.370	7.030	2.220
01/31/17	8.340	2.330	11.60	2.530	9.290	2.380	10.20	2.440	10.10	2.440	9.750	2.410	8.930	2.360	8.690	2.340
02/07/17	17.20	2.890	20.70	3.070	18.60	2.960	15.30	2.790	18.90	2.980	17.40	2.900	16.10	2.830	14.00	2.720
02/14/17	17.70	2.830	19.80	3.060	18.20	2.780	19.60	2.890	15.20	2.650	15.70	2.690	18.30	2.840	15.70	2.670
02/22/17	13.50	2.300	14.40	2.370	14.60	2.430	13.70	2.350	11.90	2.240	14.20	2.370	14.00	2.350	12.40	2.280
02/28/17	9.430	2.730	14.80	3.030	12.80	2.820	11.20	2.780	13.50	2.930	12.70	2.890	10.90	2.790	14.10	2.940
03/07/17	14.30	2.620	18.00	2.830	14.50	2.710	16.30	2.770	16.90	2.800	15.00	2.690	16.30	2.750	14.70	2.710
03/15/17	11.20	2.250	15.20	2.480	14.10	2.420	12.20	2.310	12.40	2.320	12.80	2.340	14.40	2.430	13.10	2.360
03/21/17	14.70	3.030	18.20	3.230	12.80	2.930	14.30	3.010	10.30	2.770	11.60	2.850	16.80	3.150	13.60	2.980
03/29/17	16.50	2.710	20.20	2.900	20.30	2.910	17.50	2.790	<	2.840	16.80	2.740	15.70	2.680	18.10	2.810
04/04/17	7.090	2.560	8.560	2.640	8.820	2.640	6.440	2.480	8.260	2.620	6.410	2.490	7.210	2.550	6.780	2.500
04/11/17	9.950	2.330	11.50	2.400	12.20	2.380	13.60	2.530	12.10	2.440	10.70	2.360	10.40	2.330	12.20	2.420
04/19/17	14.50	2.410	16.10	2.520	17.60	2.630	14.60	2.480	13.90	2.410	13.00	2.360	14.80	2.460	13.90	2.420
04/25/17	9.250	2.650	9.600	2.660	7.910	2.590	6.230	2.420	7.720	2.560	4.890	2.330	7.240	2.510	5.620	2.400
05/03/17	11.90	2.230	10.90	2.200	11.20	2.160	10.60	2.380	9.030	2.070	9.910	2.130	9.940	2.130	9.220	2.070
05/09/17	10.00	2.830	7.370	2.580	9.410	2.720	8.760	2.670	5.990	2.480	6.330	2.510	7.560	2.600	6.260	2.510
05/16/17	11.60	2.580	12.00	2.610	10.40	2.510	7.010	2.290	9.360	2.450	9.820	2.480	11.80	2.590	11.20	2.550
05/23/17	15.70	2.830	17.80	2.940	18.50	3.020	15.50	2.850	12.50	2.640	14.40	2.750	13.40	2.700	11.90	2.610
05/30/17	7.690	2.330	10.90	2.540	9.570	2.430	3.570	2.040	7.390	2.330	9.120	2.430	11.50	2.570	8.320	2.370
06/06/17	15.00	2.790	17.90	2.970	15.00	2.810	14.10	2.770	11.00	2.600	16.10	2.870	16.90	2.910	14.20	2.780
06/13/17	13.10	2.530	13.60	2.520	16.20	2.750	11.70	2.440	16.10	2.680	14.90	2.610	13.70	2.540	9.510	2.310
06/20/17	15.00	2.690	15.40	2.710	18.10	2.870	12.00	2.510	9.110	2.320	14.50	2.660	12.90	2.570	9.150	2.330
06/28/17	13.50	2.490	16.70	2.650	12.60	2.350	16.90	2.620	13.50	2.450	10.30	2.280	14.80	2.530	14.50	2.500

TABLE 3-3
AIR PARTICULATES
GROSS BETA RADIOACTIVITY
(10^{-3} pCi/m^3)

LOCATIONS

PERIOD ENDING	01	(+/-)	02	(+/-)	03	(+/-)	04	(+/-)	05	(+/-)	06	(+/-)	07	(+/-)	21	(+/-)
07/05/17	12.40	2.930	16.70	3.210	15.80	3.180	16.10	3.190	12.60	3.020	12.30	3.010	14.70	3.120	13.30	3.040
07/11/17	14.10	2.890	12.90	2.780	15.10	3.010	13.60	2.860	10.00	2.620	13.60	2.830	14.30	2.870	12.70	2.810
07/18/17	16.10	2.890	23.50	3.260	14.70	2.810	22.60	3.210	16.40	2.890	20.40	3.110	20.20	3.100	18.10	2.990
07/25/17	15.10	2.730	20.10	2.990	21.00	3.030	18.70	2.920	17.90	2.880	17.40	2.850	21.40	3.050	19.20	2.950
08/02/17	9.680	2.190	12.20	2.340	12.90	2.380	8.000	2.090	9.960	2.210	11.90	2.320	10.30	2.240	9.780	2.690
08/08/17	11.40	2.690	14.20	2.870	13.70	2.840	13.20	2.810	14.50	2.890	10.90	2.670	12.70	2.780	11.70	2.720
08/15/17	13.10	2.630	16.90	2.830	12.30	2.590	14.20	2.680	11.10	2.510	15.10	2.730	14.40	2.690	15.60	2.770
08/22/17	20.30	3.070	25.00	3.310	19.50	3.020	20.80	3.100	16.80	2.890	20.70	3.090	20.60	3.090	18.40	2.970
08/30/17	9.110	2.070	14.60	2.390	8.860	2.060	12.40	2.260	8.980	2.060	11.90	2.240	12.90	2.290	13.40	2.320
09/05/17	17.30	3.210	12.80	2.950	15.50	3.110	12.30	2.920	13.40	2.990	15.80	3.130	16.50	3.170	15.90	3.140
09/12/17	11.00	2.420	11.00	2.420	10.70	2.400	10.10	2.360	7.130	2.170	12.90	2.530	9.020	2.300	11.10	2.430
09/19/17	14.10	2.620	15.00	2.670	15.20	2.690	17.90	2.840	11.00	2.430	14.20	2.630	14.90	2.670	14.00	2.620
09/27/17	17.60	2.510	22.50	2.750	14.90	2.370	20.20	2.650	13.90	2.330	14.60	2.360	14.50	2.350	18.70	2.580
10/04/17	14.00	2.530	13.60	2.490	14.10	2.510	14.40	2.530	12.30	2.400	11.90	2.380	14.20	2.520	14.90	2.560
10/10/17	10.90	2.570	11.20	2.590	13.80	2.790	7.960	2.400	9.580	2.490	11.90	2.640	11.20	2.590	13.80	2.790
10/17/17	8.960	2.160	10.50	2.310	7.480	2.010	5.880	1.930	7.550	2.080	8.440	2.150	7.560	2.090	7.760	2.070
10/24/17	22.20	3.170	25.20	3.260	28.50	3.510	28.80	3.470	22.70	3.160	24.40	3.240	23.10	3.170	27.30	3.390
10/31/17	9.170	2.290	11.60	2.570	11.10	2.540	10.60	2.380	8.800	2.270	11.70	2.450	8.290	2.230	8.730	2.260
11/08/17	15.00	2.420	16.70	2.530	13.80	2.320	14.80	2.410	14.50	2.400	15.00	2.430	15.90	2.470	17.50	2.540
11/15/17	16.30	2.780	22.10	3.060	20.00	3.020	16.80	2.800	13.80	2.620	14.90	2.720	17.90	2.840	19.40	2.950
11/21/17	17.80	3.230	22.10	3.450	18.00	3.240	22.50	3.470	18.50	3.260	14.00	3.010	18.40	3.250	18.80	3.280
11/28/17	19.00	2.840	18.30	2.950	16.50	2.610	16.00	2.680	15.20	2.650	17.30	2.770	15.20	2.660	20.90	2.930
12/05/17	23.10	3.380	27.30	3.500	26.40	3.460	27.50	3.510	22.10	3.260	22.20	3.260	25.40	3.410	22.10	3.260
12/13/17	17.40	2.620	16.60	2.590	17.30	2.690	15.20	2.550	14.40	2.520	15.60	2.560	14.10	2.480	15.40	2.560
12/19/17	11.00	2.710	18.50	3.160	18.60	3.170	18.40	3.150	17.80	3.140	13.90	2.890	18.30	3.140	12.60	2.820
12/26/17	16.10	2.840	18.20	2.920	17.60	2.800	15.00	2.700	17.90	2.870	10.30	2.460	13.60	2.660	13.90	2.640
Mean	13.52	2.638	15.66	2.759	14.62	2.698	14.11	2.666	12.70	2.590	13.17	2.615	13.96	2.658	13.51	2.642

TABLE 3-3
AIR PARTICULATES
GROSS BETA RADIOACTIVITY
(10^{-3} pCi/m^3)

LOCATIONS

PERIOD ENDING	22	(+/-)	23	(+/-)	24*	(+/-)	01A	(+/-)	05A	(+/-)
01/04/17	6.900	1.970	10.90	2.190	11.90	2.280	8.940	2.060	10.00	2.160
01/11/17	8.600	2.310	12.90	2.560	15.10	2.690	9.750	2.370	15.20	2.700
01/17/17	8.810	2.640	11.30	2.800	14.30	2.980	10.30	2.740	14.90	3.020
01/24/17	7.340	2.240	8.970	2.350	9.920	2.420	6.780	2.200	9.360	2.380
01/31/17	6.980	2.230	9.010	2.370	7.650	2.280	7.670	2.280	9.600	2.400
02/07/17	11.80	2.590	20.20	3.040	14.20	2.720	11.50	2.570	14.70	2.750
02/14/17	15.00	2.630	19.20	2.900	18.50	2.810	17.80	2.830	19.50	2.880
02/22/17	9.990	2.140	14.90	2.390	11.80	2.260	8.410	2.010	14.10	2.370
02/28/17	9.690	2.670	12.50	2.900	12.90	2.850	7.690	2.600	9.900	2.710
03/07/17	10.40	2.440	18.00	2.840	15.60	2.760	10.50	2.400	17.80	2.850
03/15/17	10.60	2.210	14.90	2.460	13.50	2.380	11.60	2.270	13.30	2.370
03/21/17	11.50	2.860	15.70	3.090	14.10	3.010	13.70	2.970	13.90	2.990
03/29/17	11.00	2.470	19.90	2.880	21.00	2.940	14.40	2.610	18.10	2.810
04/04/17	4.580	2.340	8.220	2.630	11.80	2.830	5.380	2.430	11.10	2.790
04/11/17	8.700	2.200	13.20	2.520	12.60	2.430	13.60	2.550	7.650	2.150
04/19/17	11.10	2.270	16.20	2.510	14.80	2.480	14.30	2.400	14.50	2.440
04/25/17	4.410	2.310	7.090	2.500	7.980	2.570	6.910	2.490	6.430	2.470
05/03/17	7.220	1.940	10.10	2.150	13.40	2.300	9.800	2.140	11.10	2.190
05/09/17	6.870	2.550	7.820	2.610	6.470	2.650	6.690	2.540	6.590	2.530
05/16/17	8.160	2.360	9.420	2.450	10.40	2.510	10.60	2.520	10.40	2.510
05/23/17	12.40	2.640	18.00	2.950	14.00	2.740	11.60	2.590	14.90	2.780
05/30/17	7.920	2.340	10.90	2.530	11.20	2.560	9.940	2.480	10.90	2.540
06/06/17	10.60	2.570	17.00	2.920	18.10	2.980	14.00	2.760	14.30	2.770
06/13/17	15.50	2.670	15.00	2.600	12.50	2.510	10.40	2.320	11.20	2.410
06/20/17	12.40	2.540	17.80	2.850	14.30	2.650	14.30	2.650	13.00	2.570
06/28/17	8.520	2.160	13.60	2.490	15.80	2.540	12.80	2.450	14.90	2.530

*Control Station

TABLE 3-3
AIR PARTICULATES
GROSS BETA RADIOACTIVITY
(10^{-3} pCi/m^3)

LOCATIONS

PERIOD ENDING	22	(+/-)	23	(+/-)	24*	(+/-)	01A	(+/-)	05A	(+/-)
07/05/17	11.60	2.950	12.30	2.990	15.80	3.180	10.90	2.920	14.20	3.100
07/11/17	13.60	2.870	15.50	2.930	14.40	2.930	9.450	2.540	15.60	2.970
07/18/17	13.20	2.720	12.90	2.710	18.20	2.990	12.10	2.660	22.80	3.220
07/25/17	14.30	2.690	19.60	2.960	13.90	2.660	15.10	2.730	20.90	3.030
08/02/17	8.000	2.090	13.00	2.390	12.30	2.350	9.680	2.190	12.00	2.330
08/08/17	7.780	2.460	13.50	2.820	9.240	2.560	8.950	2.530	12.50	2.770
08/15/17	6.050	2.200	13.00	2.620	14.50	2.710	10.90	2.500	12.30	2.570
08/22/17	13.90	2.710	23.20	3.210	18.80	2.980	15.50	2.820	20.00	3.060
08/30/17	10.90	2.180	12.10	2.250	13.40	2.320	10.80	2.170	15.50	2.430
09/05/17	11.90	2.890	18.50	3.280	17.70	3.230	14.00	3.020	12.00	2.900
09/12/17	7.480	2.200	10.20	2.370	12.70	2.520	10.10	2.360	10.40	2.380
09/19/17	7.170	2.170	17.20	2.800	17.60	2.820	11.80	2.480	18.30	2.860
09/27/17	20.40	2.670	17.60	2.520	22.40	2.750	14.60	2.350	21.00	2.690
10/04/17	16.10	2.620	14.20	2.530	13.40	2.470	9.790	2.260	13.40	2.470
10/10/17	12.40	2.700	10.20	2.530	12.40	2.690	10.40	2.540	11.50	2.620
10/17/17	10.20	2.250	6.800	2.060	10.60	2.240	7.850	2.140	9.620	2.220
10/24/17	20.00	3.040	25.90	3.280	23.80	3.270	22.00	3.080	22.30	3.150
10/31/17	9.910	2.340	9.250	2.300	8.360	2.240	9.990	2.340	7.470	2.180
11/08/17	13.10	2.310	11.70	2.260	12.90	2.290	13.50	2.370	15.20	2.430
11/15/17	12.80	2.580	17.70	2.820	17.80	2.850	13.90	2.600	12.80	2.560
11/21/17	16.60	3.160	15.50	3.100	18.60	3.270	13.10	2.960	16.10	3.130
11/28/17	15.80	2.660	17.80	2.820	17.00	2.670	11.90	2.490	17.50	2.770
12/05/17	24.30	3.370	25.10	3.400	22.10	3.260	19.40	3.130	25.10	3.400
12/13/17	14.40	2.510	18.20	2.660	17.10	2.660	16.40	2.570	14.20	3.370
12/19/17	17.20	3.090	16.90	3.060	18.80	3.190	16.50	3.040	12.70	2.820
12/26/17	14.00	2.620	17.30	2.900	14.60	2.690	15.40	2.800	12.60	2.580
Mean	11.35	2.507	14.57	2.693	14.47	2.691	11.80	2.535	13.95	2.675
							Mean all indicatior location		13.58	2.640

*Control Station

TABLE 3-4
AIRBORNE IODINE
(10^{-3} pCi/m^3)

PERIOD ENDING	LOCATIONS 01	02	03	04	05	06	07	21
01/04/17	< 24.36	< 24.70	< 25.51	< 25.00	< 21.12	< 21.03	< 20.96	< 21.22
01/11/17	< 12.08	< 28.89	< 28.89	< 28.89	< 28.89	< 22.21	< 22.21	< 22.21
01/17/17	< 11.72	< 27.83	< 27.83	< 27.89	< 27.89	< 30.43	< 30.43	< 30.43
01/24/17	< 12.83	< 30.53	< 30.59	< 30.53	< 30.53	< 26.90	< 26.90	< 26.95
01/31/17	< 9.597	< 27.21	< 27.17	< 27.21	< 27.21	< 26.38	< 26.38	< 18.50
02/07/17	< 29.04	< 11.28	< 29.04	< 29.04	< 29.04	< 32.36	< 32.36	< 32.36
02/14/17	< 12.66	< 34.58	< 31.19	< 31.79	< 31.91	< 48.36	< 48.53	< 47.85
02/22/17	< 14.68	< 26.89	< 27.77	< 27.22	< 27.14	< 26.50	< 26.38	< 26.78
02/28/17	< 12.55	< 29.48	< 28.24	< 29.00	< 29.11	< 29.93	< 30.05	< 29.44
03/07/17	< 26.08	< 11.11	< 27.34	< 26.72	< 26.62	< 18.78	< 18.72	< 19.18
03/15/17	< 11.75	< 28.01	< 27.97	< 28.01	< 28.01	< 12.24	< 31.51	< 31.46
03/21/17	< 12.12	< 28.91	< 29.03	< 28.91	< 28.91	< 37.06	< 37.06	< 37.21
03/29/17	< 12.06	< 34.39	< 34.55	< 34.66	< 34.50	< 32.08	< 32.08	< 32.23
04/04/17	< 17.48	< 33.63	< 33.29	< 33.29	< 33.49	< 35.68	< 35.68	< 35.32
04/11/17	< 10.20	< 23.98	< 23.08	< 23.94	< 23.98	< 19.84	< 19.77	< 19.49
04/19/17	< 12.79	< 23.56	< 24.04	< 24.07	< 23.60	< 26.17	< 26.13	< 26.41
04/25/17	< 12.42	< 29.36	< 30.09	< 29.25	< 29.72	< 24.40	< 24.54	< 24.59
05/03/17	< 11.47	< 27.66	< 26.66	< 31.25	< 27.40	< 25.41	< 25.49	< 25.14
05/09/17	< 11.44	< 26.28	< 26.39	< 26.28	< 26.28	< 24.61	< 24.66	< 24.66
05/16/17	< 16.56	< 39.48	< 39.54	< 39.54	< 39.61	< 24.70	< 24.65	< 24.61
05/23/17	< 14.57	< 37.51	< 38.24	< 38.04	< 37.44	< 38.65	< 38.65	< 38.65
05/30/17	< 33.07	< 33.19	< 32.61	< 33.07	< 34.00	< 33.70	< 33.70	< 33.64
06/06/17	< 14.77	< 35.71	< 35.65	< 35.77	< 35.84	< 13.37	< 13.37	< 13.40
06/13/17	< 27.34	< 26.92	< 28.03	< 27.30	< 24.79	< 24.66	< 24.62	< 25.01
06/20/17	< 13.82	< 32.96	< 33.01	< 32.90	< 32.90	< 29.41	< 29.41	< 29.46
06/28/17	< 31.57	< 31.32	< 12.62	< 30.65	< 30.80	< 36.14	< 36.25	< 35.86

TABLE 3-4
AIRBORNE IODINE
(10^{-3} pCi/m^3)

PERIOD ENDING	LOCATIONS 01	02	03	04	05	06	07	21
07/05/17	< 18.16	< 44.66	< 44.89	< 44.89	< 44.89	< 30.81	< 30.76	< 30.60
07/11/17	< 38.18	< 37.49	< 39.23	< 38.10	< 28.86	< 28.68	< 28.63	< 29.16
07/18/17	< 16.62	< 32.18	< 32.13	< 32.07	< 32.07	< 29.37	< 29.37	< 29.32
07/25/17	< 21.91	< 9.24	< 21.91	< 21.91	< 21.91	< 21.10	< 21.10	< 21.10
08/02/17	< 29.58	< 29.62	< 29.62	< 29.62	< 24.39	< 24.39	< 24.39	< 31.87
08/08/17	< 9.763	< 27.74	< 27.79	< 27.85	< 27.79	< 30.71	< 30.71	< 30.77
08/15/17	< 12.90	< 23.33	< 23.41	< 23.29	< 23.29	< 23.42	< 23.42	< 23.46
08/22/17	< 28.44	< 28.44	< 28.29	< 28.44	< 25.83	< 25.83	< 25.83	< 25.70
08/30/17	< 18.71	< 33.96	< 34.01	< 33.96	< 33.96	< 40.99	< 40.99	< 41.05
09/05/17	< 24.78	< 29.57	< 29.57	< 29.57	< 29.57	< 44.55	< 44.55	< 44.55
09/12/17	< 14.38	< 34.10	< 34.10	< 34.16	< 34.16	< 24.73	< 24.73	< 24.73
09/19/17	< 11.36	< 27.09	< 27.09	< 27.04	< 27.04	< 25.90	< 25.90	< 25.90
09/27/17	< 12.60	< 30.22	< 30.26	< 30.36	< 30.31	< 23.39	< 23.39	< 23.46
10/04/17	< 13.28	< 31.45	< 31.28	< 31.23	< 31.34	< 28.31	< 28.36	< 28.21
10/10/17	< 10.45	< 24.79	< 25.14	< 25.20	< 24.89	< 25.86	< 25.80	< 26.17
10/17/17	< 19.26	< 47.15	< 44.60	< 45.60	< 46.41	< 36.45	< 36.58	< 35.75
10/24/17	< 9.99	< 23.23	< 24.33	< 23.68	< 23.52	< 20.50	< 20.43	< 20.68
10/31/17	< 11.44	< 29.15	< 29.26	< 27.27	< 27.27	< 21.84	< 21.84	< 21.84
11/08/17	< 31.16	< 31.60	< 30.56	< 31.21	< 29.02	< 29.11	< 29.02	< 28.80
11/15/17	< 13.89	< 32.65	< 33.82	< 33.11	< 32.99	< 22.49	< 22.02	< 22.33
11/21/17	< 50.82	< 50.82	< 50.92	< 50.82	< 38.40	< 38.40	< 38.40	< 38.48
11/28/17	< 30.33	< 32.85	< 15.83	< 30.38	< 30.54	< 39.40	< 39.54	< 38.86
12/05/17	< 16.22	< 18.81	< 18.78	< 18.78	< 18.78	< 28.22	< 28.22	< 28.27
12/13/17	< 39.40	< 39.76	< 41.19	< 40.37	< 22.37	< 22.03	< 21.96	< 22.16
12/19/17	< 11.86	< 28.29	< 28.46	< 28.29	< 28.58	< 36.59	< 36.59	< 36.82
12/26/17	< 16.25	< 28.93	< 27.80	< 28.33	< 28.57	< 37.01	< 37.14	< 36.49

TABLE 3-4
AIRBORNE IODINE
(10^{-3} pCi/m^3)

PERIOD ENDING	LOCATIONS 22	23	24*	01A	05A
01/04/17	< 25.56	< 25.13	< 25.75	< 10.50	< 25.44
01/11/17	< 22.21	< 32.38	< 32.50	< 32.38	< 32.50
01/17/17	< 30.49	< 28.05	< 27.93	< 28.05	< 27.99
01/24/17	< 26.95	< 28.12	< 28.17	< 28.12	< 28.12
01/31/17	< 26.33	< 21.10	< 21.07	< 21.10	< 21.10
02/07/17	< 32.36	< 25.33	< 25.33	< 25.33	< 25.33
02/14/17	< 47.85	< 29.42	< 28.61	< 29.58	< 28.96
02/22/17	< 26.78	< 25.16	< 25.90	< 25.12	< 25.58
02/28/17	< 29.44	< 28.38	< 27.41	< 28.56	< 27.97
03/07/17	< 19.01	< 26.95	< 27.62	< 26.68	< 27.23
03/15/17	< 31.46	< 31.51	< 30.46	< 30.51	< 30.51
03/21/17	< 37.21	< 29.46	< 29.58	< 29.46	< 29.46
03/29/17	< 32.83	< 37.32	< 37.49	< 37.21	< 37.49
04/04/17	< 35.32	< 22.25	< 21.97	< 22.34	< 22.02
04/11/17	< 19.49	< 22.04	< 21.36	< 22.16	< 21.96
04/19/17	< 26.41	< 32.91	< 33.83	< 32.77	< 33.32
04/25/17	< 24.59	< 28.14	< 28.26	< 15.50	< 28.31
05/03/17	< 25.14	< 26.36	< 25.64	< 26.53	< 26.00
05/09/17	< 24.66	< 26.04	< 27.69	< 10.92	< 25.99
05/16/17	< 24.61	< 38.37	< 38.37	< 38.30	< 38.43
05/23/17	< 38.65	< 45.37	< 45.45	< 45.30	< 45.22
05/30/17	< 40.00	< 15.51	< 40.07	< 40.00	< 40.00
06/06/17	< 13.40	< 30.64	< 30.64	< 30.64	< 30.58
06/13/17	< 28.51	< 27.88	< 28.71	< 9.764	< 28.31
06/20/17	< 29.46	< 31.64	< 31.69	< 31.64	< 31.58
06/28/17	< 35.86	< 28.80	< 27.85	< 28.98	< 28.32

*Control Station

TABLE 3-4
AIRBORNE IODINE
(10^{-3} pCi/m^3)

PERIOD ENDING	LOCATIONS 22	23	24*	01A	05A
07/05/17	< 30.60	< 38.06	< 38.33	< 38.00	< 38.33
07/11/17	< 27.16	< 26.45	< 27.33	< 10.19	< 26.94
07/18/17	< 29.32	< 27.72	< 27.67	< 27.72	< 27.62
07/25/17	< 21.10	< 22.87	< 22.87	< 22.87	< 22.87
08/02/17	< 31.08	< 31.08	< 31.08	< 13.09	< 31.08
08/08/17	< 30.77	< 35.44	< 35.59	< 35.44	< 35.59
08/15/17	< 23.46	< 29.12	< 29.17	< 29.17	< 29.02
08/22/17	< 24.78	< 24.91	< 10.39	< 24.91	< 24.91
08/30/17	< 41.05	< 35.48	< 35.53	< 35.48	< 35.48
09/05/17	< 44.55	< 44.19	< 44.19	< 44.19	< 44.19
09/12/17	< 24.73	< 28.18	< 28.18	< 28.18	< 28.23
09/19/17	< 25.90	< 27.24	< 27.24	< 27.24	< 27.19
09/27/17	< 23.50	< 33.66	< 33.76	< 33.51	< 33.86
10/04/17	< 28.16	< 28.15	< 28.00	< 28.30	< 28.00
10/10/17	< 26.17	< 15.94	< 31.31	< 30.86	< 30.99
10/17/17	< 35.81	< 43.31	< 17.39	< 43.62	< 42.24
10/24/17	< 20.68	< 31.41	< 32.70	< 13.08	< 32.02
10/31/17	< 21.84	< 23.54	< 9.93	< 23.54	< 23.54
11/08/17	< 33.63	< 34.36	< 11.82	< 34.46	< 33.89
11/15/17	< 22.37	< 33.08	< 33.60	< 32.91	< 33.54
11/21/17	< 51.64	< 51.54	< 51.64	< 21.73	< 51.54
11/28/17	< 38.86	< 35.72	< 33.85	< 35.91	< 35.10
12/05/17	< 28.27	< 21.49	< 21.45	< 21.49	< 21.45
12/13/17	< 30.84	< 30.28	< 31.08	< 12.71	< 46.55
12/19/17	< 36.82	< 20.15	< 20.28	< 20.15	< 20.15
12/26/17	< 35.99	< 41.07	< 39.85	< 41.07	< 39.85

*Control Station

TABLE 3-5
AIR PARTICULATES
(10^{-3} pCi/m^3)

GAMMA SPECTRA - QTR 1 (12/27/16 - 03/29/17)

LOCATION	Be-7	(+/-)	Cs-134	Cs-137
01	158.40	21.370	< 1.2360	< 0.8425
02	186.50	29.500	< 1.2970	< 1.1070
03	155.00	22.730	< 1.3130	< 1.3910
04	191.60	32.770	< 1.6180	< 1.8940
05	118.80	24.220	< 0.9345	< 0.9647
06	141.50	23.420	< 1.1070	< 1.1840
07	162.50	29.820	< 1.9420	< 1.8680
21	137.30	24.250	< 1.1670	< 1.0670
22	137.70	29.260	< 1.7540	< 1.5900
23	171.40	25.780	< 1.8210	< 1.3020
24*	148.70	20.130	< 0.8365	< 0.9037
01A	120.90	19.670	< 1.1490	< 1.4380
05A	182.50	31.710	< 2.1500	< 1.6650

GAMMA SPECTRA AND STRONTIUM 89/90- QTR 2 (03/29/17 - 06/28/17)

LOCATION	Be-7	(+/-)	Cs-134	Cs-137	Sr-89	Sr-90
01	151.40	20.400	< 1.0630	< 1.0270	< 5.1600	< 2.1400
02	201.70	28.140	< 1.4790	< 1.0590	< 5.1000	< 1.9000
03	138.80	24.030	< 1.4090	< 1.0490	< 4.3400	< 1.6700
04	113.50	33.050	< 2.1140	< 1.9580	< 5.4500	< 2.4100
05	133.20	22.520	< 1.0200	< 0.9860	< 4.4000	< 2.0900
06	122.70	23.000	< 1.3120	< 1.3260	< 6.0900	< 1.5400
07	154.40	31.120	< 1.8390	< 1.5560	< 4.4900	< 2.1900
21	99.390	20.110	< 1.1820	< 1.1880	< 4.6600	< 1.8300
22	135.00	26.300	< 1.6140	< 1.3490	< 4.5000	< 1.7300
23	148.80	23.880	< 1.8020	< 1.3760	< 5.0300	< 1.8100
24*	143.10	21.400	< 1.0860	< 1.0420	< 5.8600	< 2.6700
01A	109.30	22.060	< 1.4300	< 1.0490	< 6.1400	< 3.0600
05A	143.00	31.620	< 1.5790	< 1.5330	< 7.5600	< 3.2100

* Control Location

TABLE 3-5
AIR PARTICULATES
(10^{-3} pCi/m^3)

GAMMA SPECTRA - QTR 3 (06/28/17 - 09/27/17)

LOCATION	Be-7	(+/-)	Cs-134	Cs-137
01	135.70	27.160	< 1.3150	< 1.0970
02	147.40	25.520	< 1.3770	< 1.1060
03	134.70	34.850	< 1.9230	< 1.1600
04	127.00	26.470	< 0.7902	< 1.0570
05	119.40	29.220	< 1.4200	< 1.1950
06	110.30	19.920	< 1.0760	< 0.9354
07	120.90	22.980	< 1.2300	< 0.9514
21	116.30	25.460	< 1.3490	< 1.1300
22	92.090	23.310	< 1.3280	< 1.2200
23	128.60	30.960	< 2.2580	< 1.7500
24*	133.60	33.900	< 2.1120	< 1.7400
01A	111.20	23.160	< 0.7727	< 1.1640
05A	130.40	26.290	< 1.1680	< 1.0910

GAMMA SPECTRA - QTR 4 (09/27/17 - 12/26/17)

LOCATION	Be-7	(+/-)	Cs-134	Cs-137	Annual Mean Be-7	(+/-)
01	143.30	24.830	< 0.8931	< 1.3150	147.20	23.440
02	165.50	34.230	< 2.4370	< 1.9270	175.28	29.348
03	130.10	23.410	< 1.4820	< 0.6818	139.65	26.255
04	91.210	27.300	< 1.4500	< 0.8767	140.78	29.898
05	94.800	28.410	< 1.9380	< 2.2480	116.55	26.093
06	87.300	28.200	< 1.3060	< 1.3880	115.45	23.635
07	100.00	18.400	< 1.6380	< 1.3540	134.45	25.580
21	106.30	18.800	< 1.0150	< 0.9359	114.82	22.155
22	116.40	28.980	< 0.9847	< 1.2890	120.30	26.963
23	106.00	32.300	< 2.1810	< 1.3990	132.05	28.230
24*	111.20	32.870	< 1.7170	< 1.6070	134.15	27.075
01A	111.10	20.970	< 1.0940	< 1.1690	113.13	21.465
05A	111.40	26.040	< 1.4720	< 1.4470	141.83	28.915
				Mean of All indicator Locations	133.50	26.007

* Control Location

TABLE 3-6
Soil
(pCi/kg dry wt.)

LOCATION	COLLECTION DATE	Sr-89	(+/-)	Sr-90	(+/-)	K-40	(+/-)	Cs134	(+/-)	Cs-137	(+/-)	Ra-226	(+/-)
01													
02													
03													
04													
05													
06													
07													
21													
22													
23													
24*													
01A													
05A													

Soil sampled on Triennial basis. Not required in 2017

LOCATION	COLLECTION DATE	Th-228	(+/-)	Th-232	(+/-)
01					
02					
03					
04					
05					
06					
07					
21					
22					
23					
24*					
01A					
05A					

TABLE 3-7
Precipitation
(pCi/L)

LOCATION 01A

COLLECTION DATE	Gr-B	(+/-)	H-3	RainFall (inches)
01/31/17	1.8	1.1	< 1010	3.30
02/28/17	18.2	4.9	< 890	0.33
03/29/17	2.3	1.1	< 948	2.52
04/25/17	3.9	1.3	< 811	3.72
05/30/17	1.7	1.0	< 735	4.73
06/28/17	15.1	2.0	< 832	1.20
07/25/17	4.8	1.4	< 808	2.80
08/30/17	4.1	1.3	< 702	7.31
09/27/17	3.3	1.3	< 776	2.06
10/31/17	2.1	1.0	< 1080	3.09
11/28/17	2.1	1.2	< 1010	1.77
12/26/17	3.7	1.2	< 1140	0.61
Mean	5.3	1.5	-	Total 33.44

TABLE 3-7
Precipitation
(pCi/L)

LOCATION 01A

COLLECTION DATE	Be-7	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95
06/28/17	< 21.29	< 0.716	< 5.340	< 1.468	< 0.568	< 1.443	< 2.800
12/26/17	< 25.50	< 0.855	< 6.467	< 1.891	< 0.767	< 1.790	< 3.385
Mean	-	-	-	-	-	-	-

COLLECTION DATE	Nb-95	Cs-134	Cs-137	Ba-140	La-140	I-131	Th-228
06/28/17	< 1.839	< 0.619	< 0.512	< 740.2	< 263.0	< 7469	< 1.671
12/26/17	< 2.099	< 0.821	< 0.824	< 1136	< 334.3	< 11810	< 1.364
Mean	-	-	-	-	-	-	-

TABLE 3-8
MILK
(pCi/L)

LOCATION	COLLECTION DATE	K-40	(+/-)	Sr-89	Sr-90	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*
12A	01/17/17	1020	192	(a)	(a)	< 0.807	< 8.726	< 10.23	< 41.66	< 10.43
	02/22/17	1428	172	(a)	(a)	< 0.635	< 9.402	< 9.595	< 37.65	< 8.528
	03/21/17	1425	170	< 4.0	< 1.8	< 0.891	< 9.811	< 10.12	< 51.16	< 12.53
	04/19/17	1026	198	(a)	(a)	< 0.672	< 9.747	< 11.06	< 32.65	< 9.352
	05/16/17	1204	115	(a)	(a)	< 0.214	< 7.459	< 7.432	< 32.05	< 6.872
	06/20/17	1384	211	< 3.5	< 1.7	< 0.800	< 11.43	< 9.553	< 42.23	< 10.09
	07/18/17	1368	162	(a)	(a)	< 0.517	< 7.458	< 6.629	< 21.23	< 6.715
	08/15/17	1369	199	(a)	(a)	< 0.607	< 9.431	< 8.650	< 32.92	< 12.54
	09/19/17	1395	174	< 3.3	< 1.2	< 0.585	< 8.418	< 9.048	< 41.10	< 9.242
	10/17/17	1457	158	(a)	(a)	< 0.641	< 6.201	< 7.041	< 26.76	< 9.668
	11/21/17	1244	171	(a)	(a)	< 0.706	< 11.65	< 10.28	< 51.87	< 12.30
	12/19/17	1154	161	< 1.8	< 0.7	< 0.530	< 10.07	< 9.159	< 38.21	< 10.17
	Mean	1290	174	-	-	-	-	-	-	-

* LLD Identified in ODCM
(a) Sr-89/90 analysis performed on the last monthly sample of each quarter

TABLE 3-9
Food and Vegetation
(pCi/kg wet wt.)

LOCATION 14B

COLLECTION DATE	Be-7	(+/-)	K-40	(+/-)	I-131**	Cs-134**	Cs-137**	Ra-226	(+/-)	Ac-228	(+/-)	Th-228	(+/-)
04/11/17	717.1	183.7	5763	492.3	< 9.790	< 24.33	< 25.22	< 548.2		< 72.92		< 44.21	
05/09/17	1304	300.7	4449	566.8	< 14.60	< 29.79	< 31.60	915.7	778.1	< 103.4		71.48	51.99
06/13/17	376.7	287.4	4050	652.3	< 22.50	< 42.52	< 40.21	< 836.6		< 167.3		< 58.00	
07/11/17	892.7	231.1	6056	508.9	< 39.30	< 29.07	< 27.27	< 584.2		< 108.3		< 49.18	
08/08/17	1347	351.1	3605	585.9	< 32.40	< 48.11	< 36.19	< 858.7		< 127.5		< 61.96	
09/12/17	933.8	295.1	4180	533.1	< 28.90	< 31.13	< 30.27	< 645.1		114.3	92.95	< 49.02	
10/10/17	2784	338.9	9236	708.2	< 9.640	< 39.39	< 34.27	< 688.7		< 112.9		< 63.43	
Mean	1194	284.0	5334	578.2	-	-	-	915.7	778.1	114.3	92.95	71.48	51.99

LOCATION 15

COLLECTION DATE	Be-7	(+/-)	K-40	(+/-)	I-131**	Cs-134**	Cs-137**	Ac-228	(+/-)	Th-228	(+/-)
04/11/17	2832	209.1	7557	426.9	< 14.80	< 21.21	< 20.27	70.17	60.92	< 31.92	
05/09/17	1296	267.7	6150	573.6	< 18.40	< 32.48	< 30.10	< 108.6		< 53.84	
06/13/17	574.3	336.1	5027	580.9	< 28.20	< 36.67	< 34.02	333.9	169.1	61.13	54.92
07/11/17	1527	256.3	6424	609.1	< 31.50	< 35.03	< 30.23	< 124.0		< 43.19	
08/08/17	854.8	336.5	5601	803.4	< 25.10	< 47.37	< 37.75	526.8	203.2	< 61.97	
09/12/17	1571	335.8	4485	594.0	< 45.30	< 30.89	< 30.44	< 121.5		< 51.22	
10/10/17	2536	441.9	10420	792.9	< 11.80	< 42.92	< 38.73	< 169.8		< 75.88	
Mean	1599	311.9	6523	625.8	-	-	-	310.3	144.4	61.13	54.92

LOCATION 16*

COLLECTION DATE	Be-7	(+/-)	K-40	(+/-)	I-131**	Cs-134**	Cs-137**	Ac-228	(+/-)	Th-228	(+/-)
04/11/17	2723	213.6	6109	423.0	< 13.80	< 19.38	< 16.12	< 68.41		73.07	26.24
05/09/17	1225	228.7	5813	588.5	< 19.30	< 24.67	< 24.47	< 85.75		< 45.94	
06/13/17	668.0	266.9	4869	738.4	< 31.50	< 43.26	< 40.27	< 159.3		< 59.84	
07/11/17	647.3	343.1	4717	997.0	< 37.70	< 55.72	< 58.45	< 233.0		< 75.62	
08/08/17	1131	345.3	4536	670.8	< 27.00	< 38.96	< 31.62	< 142.2		120.3	64.24
09/12/17	2199	297.2	5299	563.8	< 25.00	< 33.06	< 31.13	< 134.1		< 57.17	
10/10/17	2890	390.1	8041	752.6	< 16.50	< 45.67	< 37.97	158.1	132.3	71.96	65.25
Mean	1640	297.8	5626	676.3	-	-	-	158.1	132.3	88.44	51.91

*Control Station

TABLE 3-9
Food and Vegetation
(pCi/kg wet wt.)

LOCATION 23

COLLECTION DATE	Be-7	(+/-)	K-40	(+/-)	I-131**	Cs-134**	Cs-137**	Ra-226		Th-228	
04/11/17	2122	346.6	8267	731.4	< 7.980	< 34.12	< 30.71	833.8	629.0	95.08	51.27
05/09/17	1930	345.8	7066	720.1	< 18.40	< 39.12	< 37.24		< 670.3		< 55.35
06/13/17	528.2	279.9	6673	678.2	< 25.90	< 38.44	< 36.10		< 786.8		< 70.36
07/11/17		< 470.7	3506	640.2	< 35.40	< 53.95	< 52.49		< 1134		< 88.79
08/08/17	1917	410.5	3016	648.5	< 44.10	< 46.21	< 46.75		< 852.6		< 83.38
09/12/17	2323	362.4	5676	607.8	< 30.40	< 34.95	< 32.79		< 700.7		< 55.85
10/10/17	1717	278.0	9994	558.1	< 42.20	< 36.69	< 37.40		< 920.6		< 68.46
Mean	1756	337.2	6314	654.9	-	-	-	833.8	629.0	95.08	51.27

LOCATION 26

COLLECTION DATE	Be-7	(+/-)	K-40	(+/-)	I-131**	Cs-134**	Cs-137**	Ra-226		Ac-228		Th-228		Th-232	
04/11/17	1726	206.5	4338	454.1	< 12.60	< 24.00	< 23.22		< 463.9		< 77.74	54.23	30.96	89.62	69.49
05/09/17	1412	401.1	4958	715.0	< 15.00	< 35.42	< 41.83		< 1064		< 174.0		< 67.55		< 173.6
06/13/17	908.5	286.3	4592	633.9	< 22.30	< 40.86	< 35.53		< 678.0	261.8	171.8	59.88	39.78		< 223.4
07/11/17	1767	254.3	4414	460.6	< 31.20	< 31.41	< 26.44	862.1	553.6	452.5	112.9	40.00	36.61		< 163.1
08/08/17	3200	512.9	3670	699.8	< 27.70	< 51.66	< 48.12		< 1068		< 186.0		< 92.83		< 185.8
09/12/17	2272	368.4	6439	681.0	< 15.10	< 29.92	< 28.97		< 532.0		< 144.8		< 59.69		< 144.4
10/10/17	1021	389.6	10850	966.1	< 9.240	< 44.11	< 45.43		< 813.1		< 173.3		< 64.56		< 172.9
Mean	1758	345.6	5609	658.6	-	-	-	862.1	553.6	357.2	142.4	51.37	35.78	89.62	69.49
All Indicator Mean	1570	319.0	5945	629.4	-	-	-	870.5	653.6	293.2	135.1	63.63	44.26	89.62	69.49

** LLD identifed in ODCM

TABLE 3-10
WELL WATER
(pCi/L)

LOCATION	COLLECTION DATE	H-3	Sr-89	Sr-90	Mn-54	Fe-59	Co-58	Co-60	Zn-65
01A	03/29/17	< 977	(a)	(a)	< 0.74	< 2.44	< 1.01	< 0.61	< 1.55
	06/28/17	< 824	< 3.32	< 0.626	< 3.39	< 10.7	< 5.24	< 5.43	< 9.58
	09/27/17	< 736	(a)	(a)	< 4.05	< 10.6	< 4.11	< 6.01	< 9.19
	12/26/17	< 1130	(a)	(a)	< 4.76	< 10.7	< 5.08	< 5.40	< 11.0
	Mean	-	-	-	-	-	-	-	-

LOCATION	COLLECTION DATE	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
01A	03/29/17	< 1.67	< 1.09	< 4.08	< 0.79	< 0.70	< 38.4	< 13.4
	06/28/17	< 9.06	< 5.74	< 9.81	< 5.24	< 5.05	< 24.3	< 8.80
	09/27/17	< 8.40	< 5.39	< 9.87	< 5.50	< 5.08	< 29.8	< 7.83
	12/26/17	< 8.87	< 6.73	< 9.84	< 5.64	< 4.98	< 28.5	< 10.1
	Mean	-	-	-	-	-	-	-

(a) Sr-89/90 analyses performed on the second quarter sample.

TABLE 3-11
River Water
(pCi/L)

LOCATION 11

COLLECTION DATE	H-3	(+/-)	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/17/17	(a)		(b)	(b)	< 7.242	< 14.68	< 7.006	< 6.270	< 13.35
02/14/17	(a)		(b)	(b)	< 4.586	< 9.015	< 3.389	< 4.421	< 10.38
03/15/17	3580	779.0	(b)	(b)	< 4.589	< 10.57	< 5.067	< 5.046	< 13.27
04/10/17	(a)		(b)	(b)	< 4.547	< 9.242	< 5.045	< 4.750	< 9.738
05/15/17	(a)		(b)	(b)	< 4.967	< 10.57	< 5.230	< 5.603	< 9.445
06/12/17	4370	791.0	< 4.470	< 0.545	< 6.294	< 10.85	< 5.722	< 4.474	< 12.02
07/11/17	(a)		(b)	(b)	< 6.396	< 10.36	< 6.764	< 9.074	< 11.10
08/08/17	(a)		(b)	(b)	< 6.798	< 12.74	< 5.770	< 6.597	< 12.19
09/11/17	4910	780.0	(b)	(b)	< 2.621	< 6.122	< 2.928	< 2.627	< 5.295
10/17/17	(a)		(b)	(b)	< 5.207	< 8.693	< 5.263	< 5.764	< 10.41
11/13/17	(a)		(b)	(b)	< 4.063	< 12.00	< 4.845	< 6.872	< 14.70
12/13/17	5420	966.0	(b)	(b)	< 1.465	< 3.103	< 1.486	< 1.488	< 2.995
Mean	4570	829.0	-	-	-	-	-	-	-

	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*
01/17/17	< 6.926	< 12.41	< 0.563	< 7.003	< 6.692	< 26.19	< 9.227
02/14/17	< 5.418	< 7.363	< 0.529	< 4.589	< 4.907	< 24.63	< 5.608
03/15/17	< 5.270	< 8.966	< 0.733	< 5.483	< 4.746	< 23.70	< 6.806
04/10/17	< 5.102	< 8.876	< 0.512	< 5.348	< 5.394	< 25.80	< 6.578
05/15/17	< 4.696	< 10.45	< 0.512	< 5.937	< 4.665	< 23.04	< 7.957
06/12/17	< 6.522	< 11.22	< 0.637	< 7.876	< 4.515	< 24.18	< 8.325
07/11/17	< 6.748	< 13.88	< 0.509	< 7.122	< 6.729	< 31.30	< 10.71
08/08/17	< 5.519	< 9.442	< 0.977	< 7.226	< 6.098	< 30.42	< 7.452
09/11/17	< 3.089	< 5.094	< 0.226	< 2.985	< 2.796	< 18.84	< 7.005
10/17/17	< 4.875	< 9.701	< 0.475	< 4.214	< 5.531	< 28.71	< 7.341
11/13/17	< 7.685	< 12.11	< 0.623	< 8.008	< 7.603	< 21.21	< 11.62
12/13/17	< 1.616	< 2.559	< 0.490	< 1.596	< 1.466	< 10.20	< 3.134
Mean	-	-	-	-	-	-	-

* LLD identified in ODCM
(a) Tritium analyses on quarterly composite
(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-12
Surface Water
(pCi/L)

LOCATION 08

COLLECTION DATE	H-3	(+/-)	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/17/17	(a)		(b)	(b)	< 6.532	< 12.72	< 6.567	< 6.232	< 14.02
02/14/17	(a)		(b)	(b)	< 3.581	< 7.883	< 4.162	< 4.092	< 8.606
03/15/17	4390	815.0	(b)	(b)	< 4.527	< 11.75	< 6.365	< 5.177	< 10.70
04/10/17	(a)		(b)	(b)	< 4.618	< 9.977	< 4.716	< 4.244	< 10.10
05/15/17	(a)		(b)	(b)	< 3.956	< 10.11	< 5.064	< 5.796	< 10.64
06/12/17	3760	758.0	< 3.940	< 0.407	< 6.432	< 11.64	< 6.158	< 4.845	< 13.69
07/11/17	(a)		(b)	(b)	< 7.233	< 14.32	< 7.674	< 8.276	< 16.44
08/08/17	(a)		(b)	(b)	< 3.952	< 9.488	< 4.571	< 5.010	< 10.06
09/11/17	5690	827.0	(b)	(b)	< 2.655	< 6.236	< 2.745	< 2.570	< 5.556
10/17/17	(a)		(b)	(b)	< 4.459	< 9.296	< 5.055	< 4.575	< 8.176
11/13/17	(a)		(b)	(b)	< 5.959	< 13.59	< 6.087	< 3.797	< 14.48
12/13/17	7130	1030	(b)	(b)	< 1.136	< 2.708	< 1.270	< 1.187	< 2.289
Mean	5243	857.5	-	-	-	-	-	-	-

	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*
01/17/17	< 6.471	< 12.94	< 0.491	< 6.341	< 6.062	< 20.75	< 13.93
02/14/17	< 3.955	< 7.046	< 0.597	< 4.077	< 4.366	< 20.92	< 7.084
03/15/17	< 6.159	< 11.01	< 0.483	< 6.525	< 5.465	< 23.78	< 9.221
04/10/17	< 5.008	< 8.116	< 0.401	< 5.304	< 5.474	< 19.97	< 6.700
05/15/17	< 4.671	< 6.997	< 0.790	< 4.766	< 5.551	< 22.59	< 7.774
06/12/17	< 7.212	< 9.879	< 0.606	< 6.849	< 6.428	< 28.53	< 9.680
07/11/17	< 7.038	< 13.18	< 0.389	< 9.197	< 7.755	< 29.62	< 12.48
08/08/17	< 5.575	< 7.705	< 0.653	< 4.655	< 4.960	< 23.19	< 8.551
09/11/17	< 3.140	< 4.970	< 0.220	< 2.781	< 2.967	< 20.79	< 5.552
10/17/17	< 5.344	< 9.328	< 0.407	< 6.136	< 5.401	< 25.51	< 9.201
11/13/17	< 6.703	< 9.516	< 0.648	< 8.162	< 7.641	< 28.22	< 9.751
12/13/17	< 1.278	< 2.260	< 0.532	< 1.288	< 1.202	< 8.825	< 2.659
Mean	-	-	-	-	-	-	-

* LLD identified in ODCM
(a) Tritium analyses on quarterly composite
(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-12
Surface Water
(pCi/L)

LOCATION 09A**

COLLECTION DATE	H-3	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/17/17	(a)	(b)	(b)	< 6.284	< 16.37	< 7.943	< 6.337	< 12.55
02/14/17	(a)	(b)	(b)	< 3.255	< 6.445	< 3.497	< 3.628	< 7.486
03/15/17	< 935	(b)	(b)	< 5.451	< 13.07	< 5.842	< 5.892	< 10.77
04/10/17	(a)	(b)	(b)	< 5.140	< 8.948	< 4.724	< 5.477	< 7.728
05/15/17	(a)	(b)	(b)	< 4.430	< 10.50	< 4.623	< 5.046	< 11.45
06/12/17	< 860	< 4.53	< 0.618	< 6.471	< 13.86	< 6.721	< 7.936	< 12.84
07/11/17	(a)	(b)	(b)	< 6.201	< 15.30	< 7.836	< 8.190	< 17.56
08/08/17	(a)	(b)	(b)	< 4.628	< 8.544	< 4.274	< 4.624	< 8.973
09/11/17	< 814	(b)	(b)	< 2.339	< 6.299	< 2.812	< 2.548	< 4.904
10/17/17	(a)	(b)	(b)	< 4.662	< 10.89	< 4.616	< 5.420	< 10.19
11/13/17	(a)	(b)	(b)	< 4.811	< 10.57	< 5.389	< 5.530	< 12.36
12/13/17	< 1170	(b)	(b)	< 1.368	< 3.310	< 1.451	< 1.426	< 2.909
Mean	-	-	-	-	-	-	-	-

	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*
01/17/17	< 7.469	< 10.27	< 0.523	< 7.130	< 6.640	< 30.15	< 7.913
02/14/17	< 4.219	< 6.890	< 0.515	< 4.144	< 4.152	< 19.36	< 5.413
03/15/17	< 6.773	< 10.81	< 0.888	< 6.716	< 5.581	< 30.01	< 9.375
04/10/17	< 4.944	< 8.116	< 0.373	< 5.223	< 5.042	< 20.39	< 6.427
05/15/17	< 4.924	< 8.505	< 0.513	< 5.628	< 5.188	< 25.61	< 8.385
06/12/17	< 6.716	< 10.65	< 0.769	< 7.863	< 8.628	< 28.90	< 7.837
07/11/17	< 8.183	< 13.13	< 0.443	< 9.076	< 7.613	< 31.39	< 10.68
08/08/17	< 5.156	< 8.342	< 0.939	< 5.452	< 3.879	< 23.10	< 7.702
09/11/17	< 2.866	< 4.793	< 0.220	< 3.135	< 2.599	< 19.43	< 5.482
10/17/17	< 4.945	< 7.913	< 0.406	< 4.819	< 5.178	< 21.81	< 9.673
11/13/17	< 5.383	< 9.463	< 0.522	< 5.250	< 5.377	< 21.98	< 6.522
12/13/17	< 1.461	< 2.650	< 0.517	< 1.528	< 1.533	< 10.16	< 3.222
Mean	-	-	-	-	-	-	-

* LLD identified in ODCM
**Control location
(a) Tritium analyses on quarterly composite
(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-13
Sediment Silt
(pCi/kg dry wt.)

LOCATION	COLLECTION DATE	Sr-89	Sr-90	K-40	(+/-)	Cs-134	Cs-137	Ra-226	(+/-)
08	04/20/17	(a)	(a)	980.0	459.3	< 47.12	< 46.64		< 962.1
09A*	04/20/17	(a)	(a)	31610	1671	< 65.89	< 53.07	1263	1163
11	04/20/17	(a)	(a)	21020	1559	< 72.48	< 54.94		< 984.4
08	10/25/17	< 297.0	< 44.10	1783	811.5	< 80.60	< 75.26		< 1763
09A*	10/17/17	< 319.0	< 34.10	21030	1697	< 83.50	< 72.18	3154	1128
11	10/25/17	< 266.0	< 43.90	23510	1809	< 75.75	< 72.41		< 1179
	Indicator Mean	-	-	11823	1160	-	-		-
	Control Mean	-	-	26320	1684	-	-	2209	1146

LOCATION	COLLECTION DATE	Th-228	(+/-)	Th-232	(+/-)
08	04/20/17	88.03	73.00		< 198
09A*	04/20/17	717.8	79.09	544.3	149.9
11	04/20/17	583.7	73.50	555.5	163.5
08	10/25/17	211.8	131.4		< 363.9
09A*	10/17/17	992.7	111.4	785.4	184.9
11	10/25/17	868.3	100.7	889.0	176.3
	Indicator Mean	438.0	94.65	722.3	169.9
	Control Mean	855.3	95.25	664.9	167.4

(a) Sr-89/90 analyses preformed annually.
* Control location, Background location

TABLE 3-14
Shoreline Soil
(pCi/kg dry wt.)

LOCATIONS

LOCATION	COLLECTION DATE	Sr-89	Sr-90	K-40	(+/-)	Cs-134	Cs-137	Ra-226
08	04/20/17	(a)	(a)	997.8	598.6	< 42.75	< 41.45	< 1027
08	10/25/17	< 283.0	< 31.40	1291	682.4	< 64.56	< 35.57	< 1021
	Mean	-	-	1144	640.5	-	-	-

LOCATION	COLLECTION DATE	Th-228	Th-232	Be-7	(+/-)
08	04/20/17	< 77.42	< 187.2		< 480.9
08	10/25/17	< 90.56	< 313.0	397.0	376.4
	Mean	-	-	397.0	376.4

* LLD identified on ODCM
(a) Sr-89/90 analyses performed annually.

TABLE 3-15
Fish
(pCi/kg wet wt.)

LOCATION	Fish Type	COLLECTION DATE	K-40	(+/-)	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
08	(a)	04/19/17	2204	569.6	< 36.73	< 78.34	< 39.97	< 29.03	< 81.07
	(b)	04/19/17	1587	635.1	< 45.26	< 121.7	< 57.92	< 67.06	< 101.5
	(a)	10/25/17	1677	663.5	< 48.88	< 103.1	< 60.90	< 51.37	< 101.4
	(b)	10/25/17	1331	543.1	< 35.97	< 135.0	< 45.31	< 50.78	< 111.2
25**	(a)	04/19/17	1293	1129	< 70.68	< 184.1	< 77.74	< 49.99	< 166.1
	(b)	04/19/17	1904	649.7	< 62.11	< 144.4	< 67.55	< 54.86	< 131.2
	(a)	10/18/17	2359	870.6	< 52.35	< 119.1	< 61.36	< 46.93	< 121.8
	(b)	11/01/17	3092	1004	< 62.97	< 180.8	< 52.83	< 51.20	< 159.5
		Mean	1931	758	-	-	-	-	-
		Indicator Mean	1700	603	-	-	-	-	-
		Control Mean	2162	913	-	-	-	-	-

LOCATION		COLLECTION DATE	Cs-134*	Cs-137*
08	(a)	04/19/17	< 36.55	< 46.23
	(b)	04/19/17	< 60.74	< 55.83
	(a)	10/25/17	< 67.00	< 58.91
	(b)	10/25/17	< 52.64	< 48.95
25**	(a)	04/19/17	< 79.08	< 61.03
	(b)	04/19/17	< 67.16	< 57.44
	(a)	10/18/17	< 63.49	< 53.31
	(b)	11/01/17	< 67.90	< 60.50
		Mean	-	-
		Indicator Mean	-	-
		Control Mean	-	-

* LLD identified in ODCM
**Control Station
(a) Non-bottom dwelling species of gamefish.
(b) Bottom dwelling species of fish.

4. DISCUSSION OF RESULTS

Data from the radiological analyses of environmental media collected during 2017 and tabulated in Section 3, are discussed below. Except for TLDs, Teledyne Brown Engineering analyzed all samples throughout the year. The procedures and specifications followed for these analyses are as required in the TBE quality assurance manuals and laboratory procedures. In addition to internal quality control measurements performed by each laboratory, they also participate in an Interlaboratory Comparison Program. Participation in this program ensures that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples are performed. The results of the Interlaboratory Comparison Programs are provided in Appendix B.

The predominant radioactivity detected throughout 2017 was that from external sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides. Naturally occurring nuclides such as Be-7, K-40, Th-228 and Th-232 were detected in numerous samples. Th-228 & Th-232 results were variable and are generally at levels higher than plant related radionuclides.

The following is a discussion and summary of the results of the environmental measurements taken during the 2017 reporting period.

4.1 Gamma Exposure Rate

A thermoluminescent dosimeter (TLD) is an inorganic crystal used to detect ambient radiation. TLDs are placed in two concentric rings around the station. The inner ring is located at the site boundary, and the outer ring is located at approximately five miles from the station. TLDs are also placed in special interest areas, such as population areas and nearby residences. Additional TLDs serve as controls. Ambient radiation comes from naturally occurring radioisotopes in the air and soil, radiation from cosmic origin, fallout from nuclear weapons testing, station effluents and direct radiation from the station.

The results of the analyses are presented in Table 3-2. Figure 4-1 shows the historical trend of TLD exposure rate measurements. Control and indicator averages indicate a steady relationship. Two dosimeters made of CaF and LiF sensitive elements are deployed at each sampling location. These TLDs replaced the previously used CaSO4:Dy in Teflon TLDs in January 2001. The dose with the replacement TLDs is lower than that of the previously used TLDs. This will continue to be monitored.

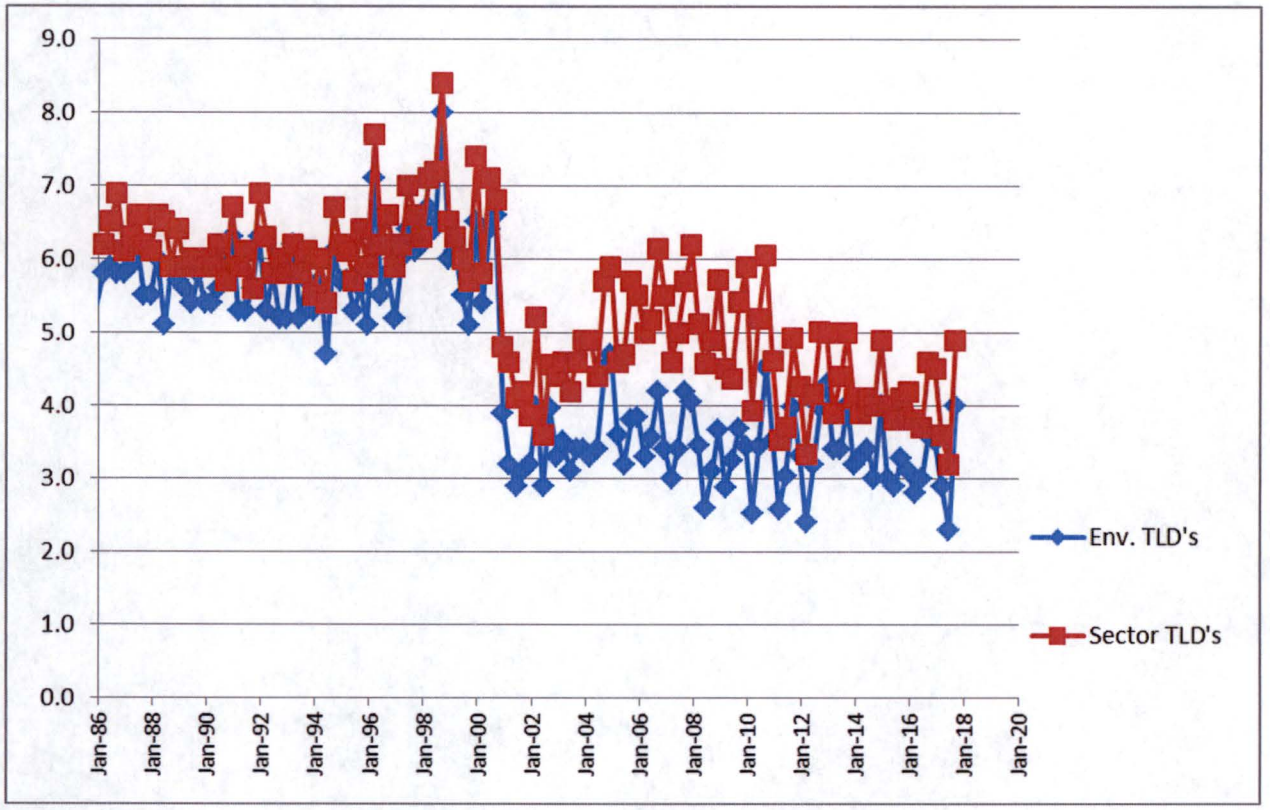

Figure 4-1 TLD (mrem/Standard Month)

Sector TLDs are deployed quarterly at thirty-two locations in the environs of the North Anna site. Two badges are placed at each location. The average level of these 32 sector TLD locations (two badges at each location) was 4.1 mR/standard month with a range of 0.8 to 9.0 mR/standard month. The highest quarterly average reading for any single location was obtained at location W-25/57. This value was 6.9 mR/standard month. This location is on site on the south gate of the switchyard. Quarterly and annual TLDs are also located at twelve environmental air sampling stations. For the eleven indicator locations within 10 miles of the station the average quarterly reading was 3.2 mR/standard month with a range of 1.2 to 6.1 mR/standard month. The average annual reading for these locations was 3.0 mR/standard month with a range from 1.3 to 4.5 mR/standard month. The control location showed a quarterly average of 2.9 mR/standard month with a range of 1.6 to 4.1 mR/standard month. Its annual reading was 3.1 mR/standard month. 10 emergency sector TLDs, which are all located onsite had a quarterly average of 5.1 mR/standard month with EPSP-9/10 having the highest quarterly average of 7.2 mR/standard month. Eight other TLDs, designated C-1 thru C-8, which were pre-operational controls, were collected quarterly from four locations. Stations C-3/4 and C-7/8 are designated controls. These had a quarterly average of 3.2 mR/ standard month, while Station C-1/2 and C-5/6 had a quarterly average of 2.7 mR/standard month with a range of 1.7 to 4.1 mR/standard month. During the pre-operational period (starting in 1977) the doses were measured between 4.3 and 8.8 mR/standard month.

4.2 Airborne Gross Beta

Results of the weekly gross beta analyses are presented in Table 3-3. A review of the historical plot in Figure 4-2, indicates gross beta activity levels have remained relatively unchanged. The drop indicated in 2009 may be a function of a return to the vendor used from 1988 until 2001. This will be monitored in the future to see if this is in fact the case. Inner and outer ring monitoring locations continue to show no significant variation in measured activities (see Figure 4-3). This indicates that any station contribution is not measurable.

Gross beta activity found during the pre-operational and early operating period of North Anna Power Station was higher because of nuclear weapons testing. During that time, nearly 740 nuclear weapons were tested worldwide. In 1985 weapons testing ceased, and with the exception of the Chernobyl accident in 1986, airborne gross beta results have remained steady. During the preoperational period of July 1, 1974 through March 31, 1978 gross beta activities ranged from a low of 0.005 pCi/m^3 to a high of 0.75 pCi/m^3.

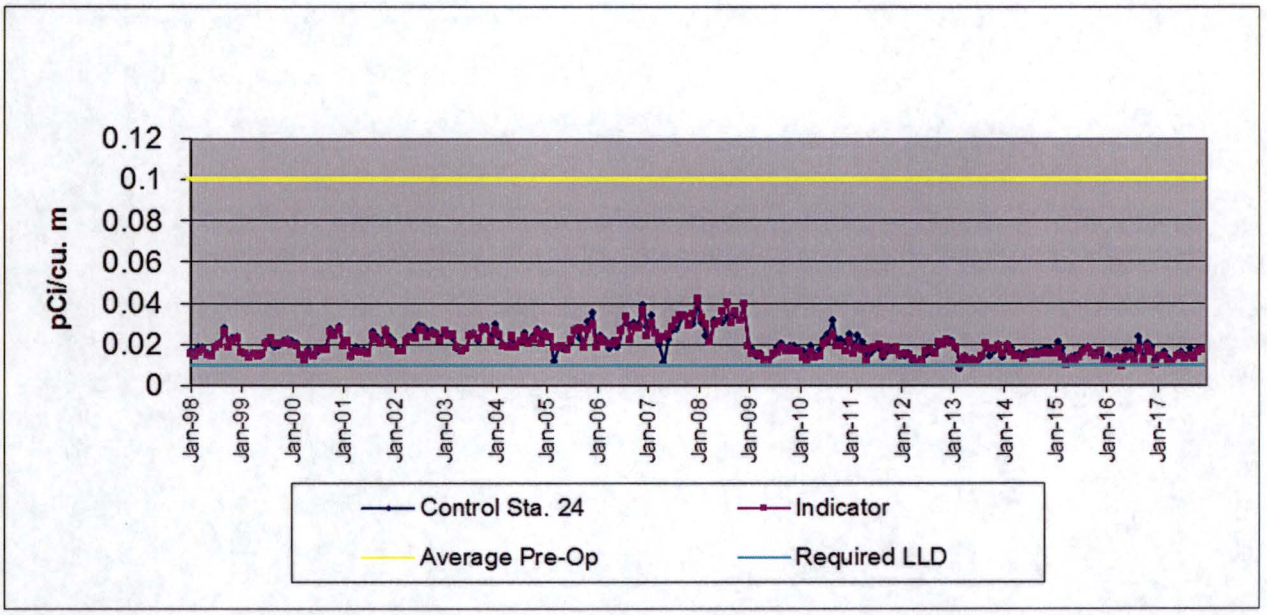

Figure 4-2 Historical Gross Beta in Air Particulates

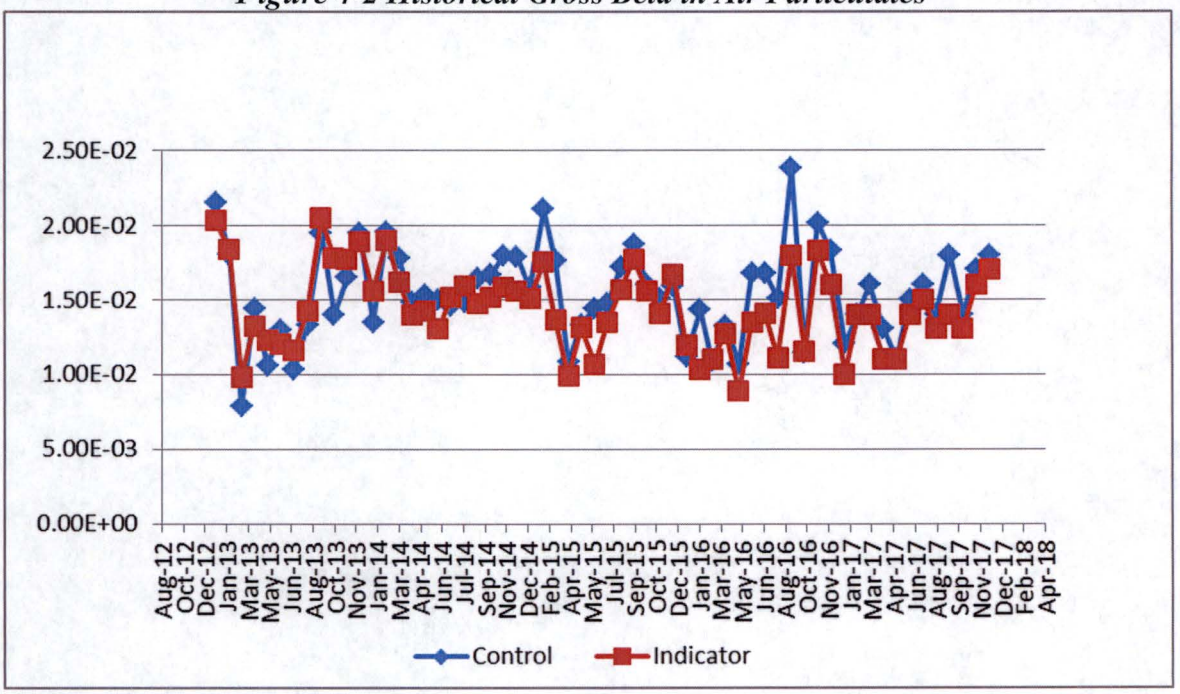

Figure 4-3 2017 Gross Beta in Air Particulates (pCi/m^3)

4.3 Airborne Radioiodine

Charcoal cartridges are used to collect airborne radioiodine. Once a week the samples are collected and analyzed. The results of the analyses are presented in Table 3-4. These results are similar to pre-operational data and the results of samples taken prior to and after the 1986 accident in the Soviet Union at Chernobyl and the effect of the Fukushima Daiichi event.

4.4 Air Particulate Gamma

The air particulate filters that are utilized for the weekly gross beta analyses are composited by location and analyzed quarterly by gamma spectroscopy. The results are listed in Table 3-5. The results indicate the presence of naturally occurring Be-7, which is produced by cosmic processes. Examination of pre-operational data indicates comparable measurements of Be-7, as would be expected. The results of these analyses indicate the lack of station effects on the environment.

4.5 Air Particulate Strontium

Strontium-89 and 90 analyses are performed on the second quarter composites of air particulate filters from all monitoring stations. There has been no detection of these fission products at any of the indicator or control stations in recent years.

4.6 Soil

Soil samples, which are collected every three years from twelve stations, were not collected in 2017.

4.7 Precipitation

A sample of rain water was collected monthly at on-site station 01A and analyzed for gross beta activity and H-3. The results are presented in Table 3-7. Twelve precipitation samples were obtained in 2016. Semi-annual composites are prepared and analyzed for gamma emitting isotopes in accordance with program requirements. No plant related isotopes were reported in any precipitation water sample at the indicator location. Naturally occurring gamma emitting radioisotopes were not detected. No positive H-3 result was reported. During the pre-operational period gross beta activity in rain water was expressed in nCi per square meter of the collector surface, thus a direct comparison cannot be made to the 2017 period. During the pre-operational period, tritium was measured in over half of the few quarterly composites made. This tritium activity ranged from 100 to 330 pCi/liter.

4.8 Cow Milk

Analysis of milk samples is generally the most sensitive indicator of fission product existence in the terrestrial environment. This pathway also shows measurable amounts of nuclear weapons testing fallout. Therefore, this media needs to be evaluated very carefully when trying to determine if there is any plant effect.

Analysis results for cow milk are contained in Table 3-8. No sample indicated positive results. Gamma spectroscopy

did not detect the presence of any isotopes related to the operation of North Anna. In years past, Cs-137 has been detected sporadically. These occurrences were attributed to residual global fallout from past atmospheric weapons testing. Naturally occurring K-40 was detected in all samples.

Once each quarter a sample from the collection station is analyzed for strontium-89 and strontium-90. Neither Sr-89 nor Sr-90 was detected. Sr-90 has been observed in the past. Pre-operational levels of 2.2 to 5.4 pCi/liter were measured for Sr-90. There has been a long-term activity trend for Sr-90 showing a continuous decline. It should be noted that strontium-90 is not a part of station effluents. Its detection is the product of nuclear weapons testing fallout. This conclusion can be made based upon the fact that Sr-89 and Sr-90 have not been detected in gaseous effluents released from the station in many years and the trend of consistent declining levels since the pre-operational period.

4.9 Food Products and Vegetation

Food/vegetation samples were collected from five locations and analyzed by gamma spectroscopy. The results of the analyses are presented in Table 3-9. Low levels of Cs-137, attributable to fallout, have been seen periodically in vegetation samples. As expected, naturally occurring potassium-40 and cosmogenic beryllium-7 were detected in most samples, and thorium-228 and other natural products, including Ra-226 and Ac-228, were detected in some samples. No plant related isotopes were identified in any vegetation sample during 2017.

4.10 Well Water

Water was sampled quarterly from the onsite well at the metrology laboratory. These samples were analyzed for gamma radiation and for tritium. The second quarter sample was analyzed by vendor for Sr-89, Sr-90, H-3, I-131, and gamma emitters. The results of these analyses are presented in Table 3-10. No plant related isotopes were detected. No gamma emitting isotopes were detected during the pre-operational period.

4.11 River Water

Samples of water from the North Anna River were collected monthly. The analyses are presented in Table 3-11. All monthly samples are analyzed by gamma spectroscopy. The monthly samples are composited quarterly and analyzed for tritium. Additionally, the second quarter samples are analyzed for strontium-89 and strontium-90 in accordance with program requirements. There has been no detection of these fission products at any of the indicator or control stations in recent years.

No gamma emitting radioisotopes were positively identified in any of the samples. There was no measured activity of strontium-89 or strontium-90. Tritium was measured in all four samples with an average annual concentration of 4570 pCi/liter and a range of 3580 to 5420 pCi/liter. These levels are comparable to those observed in previous years, see Figure 4-4. No river water samples were collected during the pre-operational period.

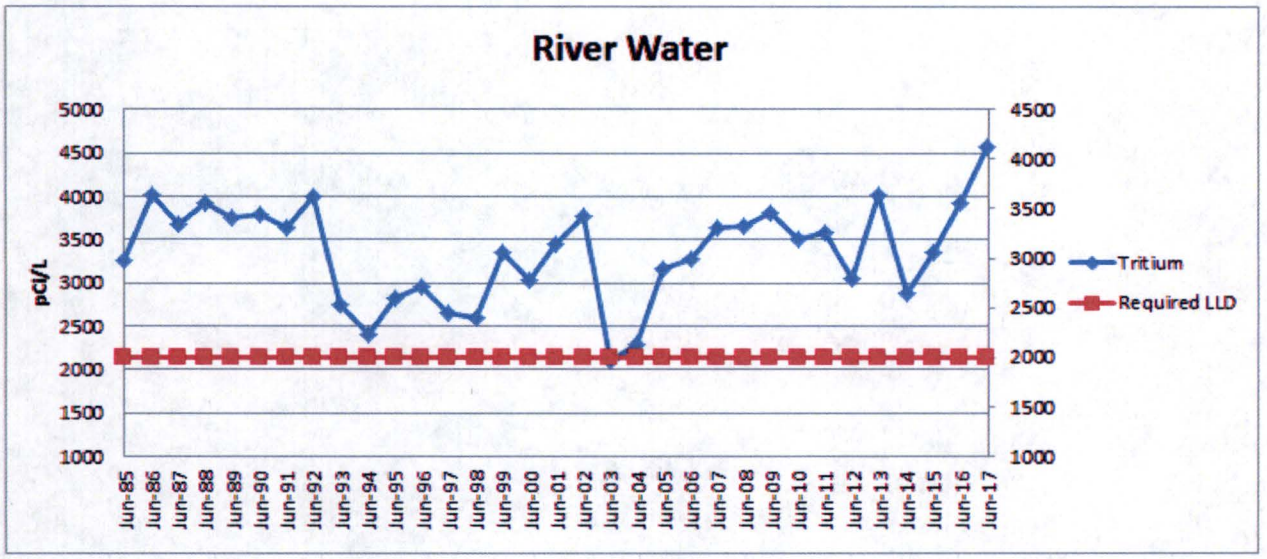

Figure 4-4 Tritium in River water

4.12 Surface Water

Samples of surface water were collected monthly from two stations, an indicator station located at the discharge lagoon and a control station located 12.9 miles WNW. The samples were analyzed by gamma spectroscopy and for iodine-131 by radiochemical separation. A quarterly composite from each station was prepared and analyzed for tritium. Additionally, the second quarter samples are analyzed for strontium-89 and strontium-90. There has been no positive indication of these fission products at any of the indicator or control stations in recent years. The results are presented in Table 3-12.

No non-naturally occurring gamma emitting radioisotopes, including iodine were detected in any of the samples. No tritium was detected at the control location. The average level of tritium activity at the indicator station was 5243 pCi/liter with a range of 3760 to 7130 pCi/liter.

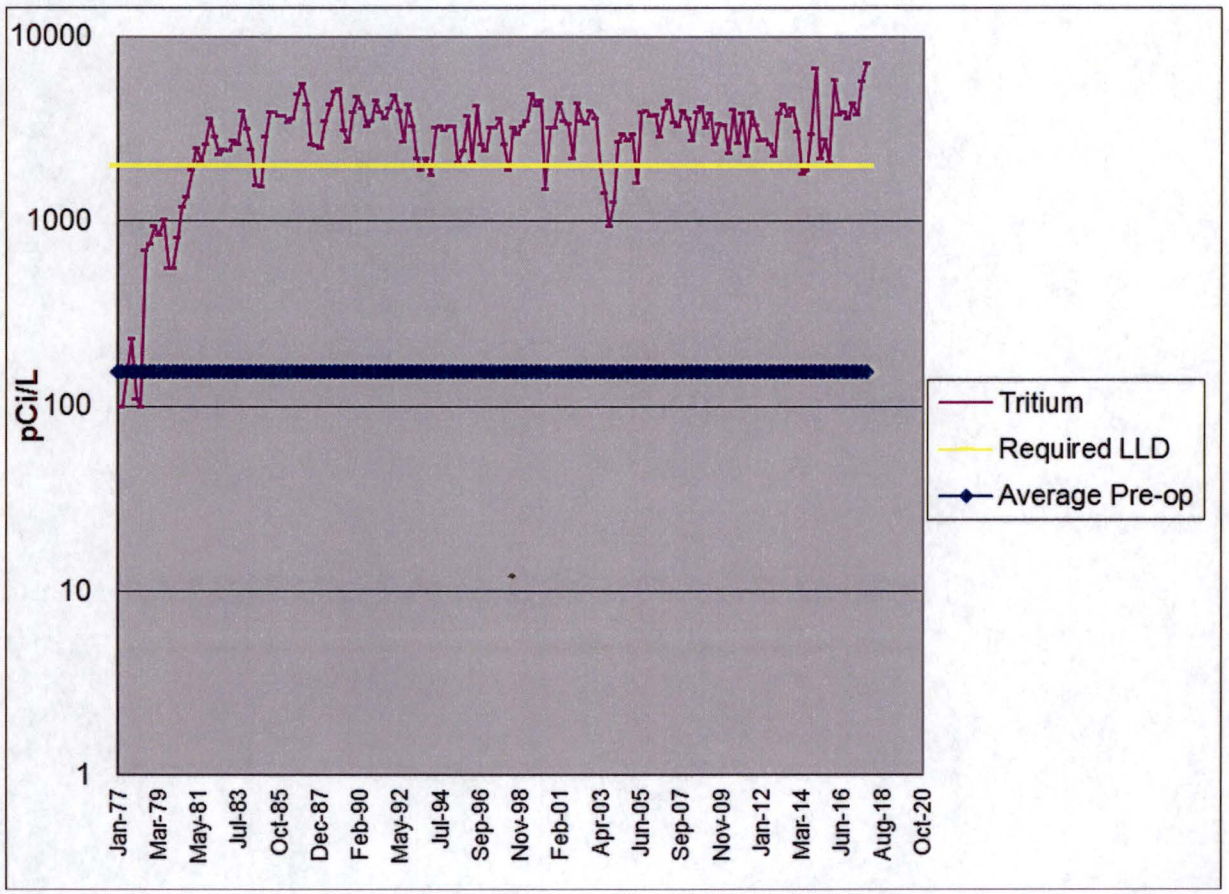

Figure 4.5 Tritium in Surface Water

4.13 Bottom Sediment

Bottom sediment or silt is sampled to evaluate any buildup of radionuclides in the environment due to the operation of the station. Buildup of radionuclides in bottom sediment could indirectly lead to increasing radioactivity levels in fish.

Sediment samples were collected during April and October from each of three locations and were analyzed by gamma spectroscopy. The October samples were analyzed for strontium-89 and strontium-90. The results are presented in Table 3-13.

No plant related isotopes were detected in 2017. The detection of Cs-137 in bottom sediment is historically common with positive indications usually apparent in both indicator and control samples. The detection of Cs-137 is the result of accumulation and runoff into the lake of residual weapons testing fallout; its global presence has been well documented. During the pre-operational period sediment samples were also analyzed by gamma spectroscopy. Figure 4-6 shows the historical trend of Cs-137 in sediments.

Neither Strontium-89 nor Strontium-90 was detected in any samples of aquatic sediment/silt in 2017. Strontium-90 has been detected occasionally in the past at both the indicator and control locations and is attributable to fallout from past bomb tests. A number of naturally occurring radioisotopes were detected in these samples at background levels.

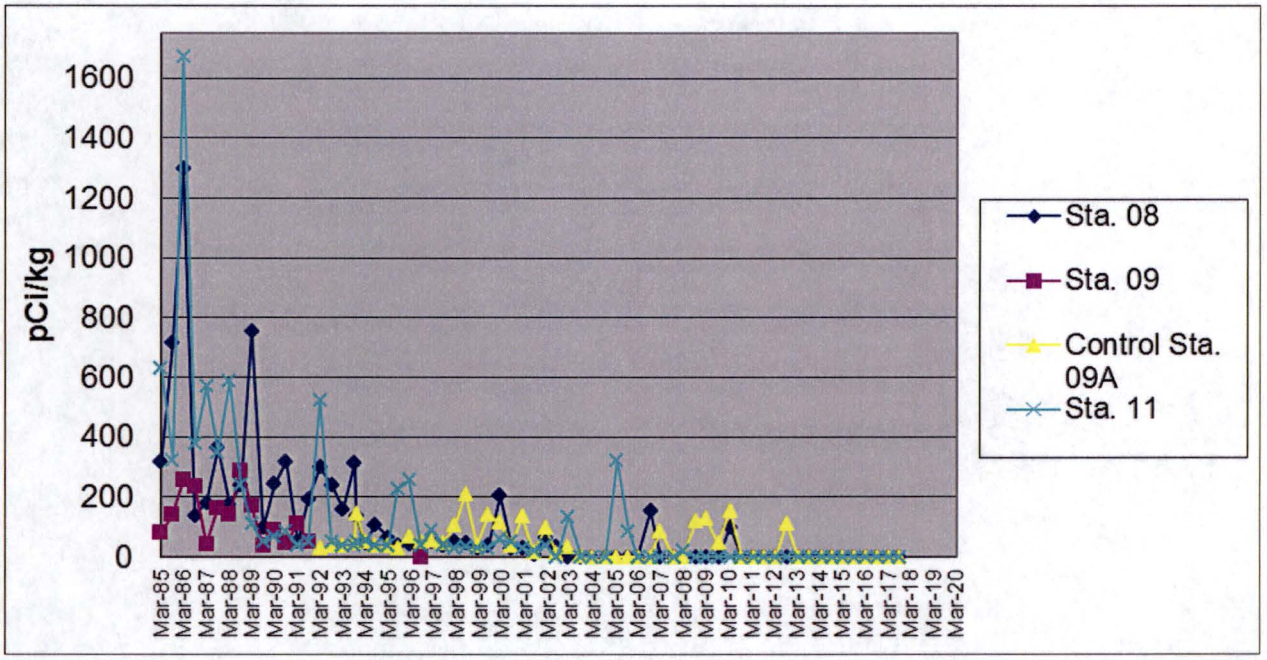

Figure 4-6 Cs-137 in Sediment/Silt

4.14 Shoreline Soil

Shoreline soil/sediment, unlike bottom sediment, may provide a direct dose to humans. Buildup of radioisotopes along the shoreline may provide a source of direct exposure for those using the area for commercial and recreational uses. Samples of shoreline soil were collected in April and October from indicator station 08. The samples were analyzed by gamma spectroscopy. The October sample was analyzed for strontium-89 and strontium-90. The results are presented in Table 3-14.

Naturally occurring radioisotopes were detected at concentrations equivalent to normal background activities. No plant related isotopes were detected in any indicator samples analyzed. Strontium-90 is often detected in this media, however as discussed previously, the presence of Sr-90 and Cs-137 is attributed to accumulation of residual global fallout from past atmospheric weapons testing.

4.15 Fish

Four sample sets of fish, two from Lake Anna and two from the control station, Lake Orange, were collected during 2017 and analyzed by gamma spectroscopy. Each sample set consisted of a sample of game species and a sample of bottom-dwelling species, which were analyzed separately. The results are presented in Table 3-15. Naturally occurring K-40 was detected in all samples. No plant related isotopes were detected. Cs-137 was measured in pre-operational environmental fish samples.

5. PROGRAM EXCEPTIONS

REMP Exceptions for Scheduled Sampling and Analysis during 2017 – North Anna

Location	Description	Date of Sampling	Reason(s) for Loss/Exception
14B,15,16,23,26	Vegetation	01/11/17	Seasonal unavailability
14B,15,16,23, 26	Vegetation	02/14/17	Seasonal unavailability
14B,15,16,23,26	Vegetation	03/15/17	Seasonal unavailability
C-7	TLD	03/29/17	Lost TLD
ENE-40	TLD	06/28/17	TLD Lost (Power Pole Damaged)
01A	Precipitation	07/17/17	February 2017 precipitation sample volume was insufficient for semiannual composite
14B,15,16,23,26	Vegetation	11/15/17	Seasonal unavailability
14B,15,16,23,26	Vegetation	12/13/17	Seasonal unavailability

Station #2 was omitted from Table 2-1 under Air Particulate and Radioiodine sampling stations in 2007 through 2016 Annual Radiological Environmental Operating Reports. This omission was documented in North Anna Condition Report CR1075273.

REFERENCES

References

Dominion, North Anna Power Station Technical Specifications, Units 1 and 2.

Dominion, North Anna Power Station Independent Spent Fuel Storage Installation Technical Specifications.

Dominion, Station Administrative Procedure, VPAP-2103N, "Offsite Dose Calculation Manual".

Virginia Electric and Power Company, North Anna Technical Procedure, HP-3051.010, "Radiological Environmental Monitoring Program".

Title 10 Code of Federal Regulation, Part 50 (10CFR50), "Domestic Licensing of Production and Utilization Facilities".

United States Nuclear Regulatory Commission Regulatory Guide 1.109, Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I", October, 1977.

United States Nuclear Regulatory Commission, Regulatory Guide 4.8 "Environmental Technical Specifications for Nuclear Power Plants", December 1975.

USNRC Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979.

NUREG 0472, "Radiological Effluent Technical Specifications for PWRs", Rev. 3, March 1982.

HASL-300, Environmental Measurements Laboratory, "EML Procedures Manual," 27th Edition, Volume 1, February 1992.

NUREG/CR-4007, "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," September 1984.

APPENDICES

APPENDIX A: LAND USE CENSUS

Year 2017

LAND USE CENSUS

North Anna Power Station

Louisa County, Virginia

January 1 to December 31, 2017

Direction	*Distance (miles)*					
	Nearest Site Boundary	*Nearest Resident*	*Nearest Garden (> 50m^2)*	*Nearest Meat Animal*	*Nearest Milch Cow*	*Nearest Milch Goat*
N	0.9	1.3	2.75	2.9	*NONE*	*NONE*
NNE	0.9	0.9	3.21	3.1	*NONE*	*NONE*
NE	0.8	0.9	1.6	1.6	*NONE*	*NONE*
ENE	0.8	2.37	2.4	2.49	*NONE*	*NONE*
E	0.8	1.3	1.75	3.5	*NONE*	*NONE*
ESE	0.9	1.7	1.7	NONE	*NONE*	*NONE*
SE	0.9	1.4	1.4	1.4	*NONE*	*NONE*
SSE	0.9	1.0	1.0	1.6	*NONE*	*NONE*
S	0.9	1.03	1.14	2.0	*NONE*	*NONE*
SSW	1	1.27	2.37	2.0	*NONE*	*NONE*
SW	1.1	1.65	1.65	NONE	*NONE*	*NONE*
WSW	1.1	1.62	2.22	NONE	*NONE*	*NONE*
W	1.1	1.5	1.93	NONE	*NONE*	*NONE*
WNW	1	1.1	2.67	4.98	*NONE*	*NONE*
NW	1	1.0	1.09	NONE	*NONE*	*NONE*
NNW	0.9	1.0	1.33	2.3	*NONE*	*NONE*

2016 to 2017 Land Use Census Changes

Nearest	Direction	2016 Distance	2017 Distance
Resident	NONE		
Site Boundary	NONE		
Garden	N	1.56	2.75
	NNE	1.22	3.21
	E	2.01	1.75
	SE	1.54	1.40
	SSW	1.33	2.37
	NW	1.28	1.09
	NNW	2.54	1.33
Meat Animal	NONE		
Milch Cow	NONE		
Milch Goat	NONE		

APPENDIX B: SUMMARY OF INTERLABORATORY COMPARISONS

YEAR 2017

ANALYTICAL SERVICES QUALITY CONTROL SYNOPSIS

A. Interlaboratory Cross-Check Program

During this reporting period, 25 nuclides associated with six media types (Air Filter, Charcoal [Air Iodine], Milk, Soil, Vegetation and Water) were analyzed. Samples were obtained from Analytics, the Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) and Environmental Resource Associates (ERA). Media types representative of client analyses performed during this reporting period were selected. The results are presented in Attachment A.

1. Analytics Environmental Cross Check Program

Fifteen nuclides in milk, air particulate, air iodine (charcoal) and water samples were evaluated for four sets of cross-checks during March – December, 2017. All of the environmental analyses performed were reported as within the acceptable/acceptable with warning criteria except for one Cr-51 in soil sample.

NCR 17-16 was initiated to address the in-house Cr-51 failure and a Corrective Action was issued. All raw data and associated QC data were reviewed and fell within acceptance limits.

2. DOE's MAPEP Quality Assessment Program

Thirteen nuclides in water, air particulate, soil, and vegetation samples were evaluated in March – December, 2017. All of the environmental analyses performed were reported as within the acceptable/acceptable with warning criteria except for one U-238 in air particulate sample.

NCR 17-15 was initiated to address the in-house U-238 failure and a Corrective Action was issued. All raw data and associated QC data were reviewed and fell within acceptance limits.

3. ERA Environmental Cross Check Program

Twelve nuclides were evaluated in air particulate and water samples during March – December, 2017. All analyses performed were within the acceptable criteria except for Zn-65, Sr-89 and Sr-90 in water samples (one each).

NCR 17-09 was initiated to address the in-house Zn-65 and Sr-89 failures. Corrective Actions for each nuclide were issued. All raw data and associated QC data were reviewed and fell within acceptance limits.

NCR 17-19 was initiated to address the in-house Sr-90 failure and a Corrective Action was issued. All raw data and associated QC data were reviewed and fell within acceptance limits.

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2017	E11811	Milk	Sr-89	pCi/L	87	97.7	0.89	A
			Sr-90	pCi/L	12.4	16.2	0.77	W
	E11812	Milk	Ce-141	pCi/L	135	145	0.93	A
			Co-58	pCi/L	153	150	1.02	A
			Co-60	pCi/L	182	183	1.00	A
			Cr-51	pCi/L	258	290	0.89	A
			Cs-134	pCi/L	104	120	0.87	A
			Cs-137	pCi/L	142	140	1.02	A
			Fe-59	pCi/L	135	129	1.05	A
			I-131	pCi/L	92.6	97.9	0.95	A
			Mn-54	pCi/L	173	164	1.05	A
			Zn-65	pCi/L	208	199	1.04	A
	E11813	Charcoal	I-131	pCi	92	93.9	0.98	A
	E11814	AP	Ce-141	pCi	99.9	101	0.99	A
			Co-58	pCi	95.4	104	0.92	A
			Co-60	pCi	140	127	1.10	A
			Cr-51	pCi	211	201	1.05	A
			Cs-134	pCi	82.1	83.2	0.99	A
			Cs-137	pCi	92.8	97.0	0.96	A
			Fe-59	pCi	107	89.3	1.20	A
			Mn-54	pCi	106	114	0.93	A
			Zn-65	pCi	137	138	0.99	A
	E11816	Soil	Ce-141	pCi/g	0.258	0.250	1.03	A
			Co-58	pCi/g	0.241	0.258	0.93	A
			Co-60	pCi/g	0.312	0.315	0.99	A
			Cr-51	pCi/g	0.439	0.500	0.88	A
			Cs-134	pCi/g	0.176	0.207	0.85	A
			Cs-137	pCi/g	0.304	0.317	0.96	A
			Fe-59	pCi/g	0.210	0.222	0.95	A
			Mn-54	pCi/g	0.292	0.283	1.03	A
			Zn-65	pCi/g	0.353	0.344	1.03	A
	E11815	Water	Fe-55	pCi/L	1600	1890	0.85	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
June 2017	E11844	Milk	Sr-89	pCi/L	81.3	92.6	0.88	A
			Sr-90	pCi/L	12.1	13.5	0.90	A
	E11846	Milk	Ce-141	pCi/L	142	151	0.94	A
			Co-58	pCi/L	147	155	0.95	A
			Co-60	pCi/L	185	191	0.97	A
			Cr-51	pCi/L	321	315	1.02	A
			Cs-134	pCi/L	168	188	0.89	A
			Cs-137	pCi/L	148	150	0.99	A
			Fe-59	pCi/L	116	115	1.01	A
			I-131	pCi/L	102	93.6	1.09	A
			Mn-54	pCi/L	168	172	0.98	A
			Zn-65	pCi/L	195	204	0.96	A
	E11847	Charcoal	I-131	pCi	87.9	84.8	1.04	A
	E11845	AP	Sr-89	pCi	70.8	79.1	0.90	A
			Sr-90	pCi	9.10	11.5	0.79	W
	E11848	AP	Ce-141	pCi	112	116	0.96	A
			Co-58	pCi	119	119	1.00	A
			Co-60	pCi	171	146	1.17	A
			Cr-51	pCi	270	241	1.12	A
			Cs-134	pCi	152	144	1.05	A
			Cs-137	pCi	114	115	0.99	A
			Fe-59	pCi	94.1	88.3	1.07	A
			Mn-54	pCi	139	132	1.06	A
			Zn-65	pCi	141	156	0.90	A
	E11849	Water	Fe-55	pCi/L	1840	1890	0.97	A
July 2017	E11901	AP	GR-A	pCi	50.1	44.2	1.13	A
			GR-B	pCi	218	233	0.93	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
September 2017	E11914	Milk	Sr-89	pCi/L	84.3	82.7	1.02	A
			Sr-90	pCi/L	12.6	12.1	1.04	A
	E11915	Milk	Ce-141	pCi/L	93.9	87.0	1.08	A
			Co-58	pCi/L	115	117	0.98	A
			Co-60	pCi/L	265	262	1.01	A
			Cr-51	pCi/L	273	217	1.26	W
			Cs-134	pCi/L	186	201	0.93	A
			Cs-137	pCi/L	175	172	1.02	A
			Fe-59	pCi/L	137	125	1.09	A
			I-131	pCi/L	78.0	71.0	1.10	A
			Mn-54	pCi/L	128	123	1.04	A
			Zn-65	pCi/L	206	184	1.12	A
	E11916	Charcoal	I-131	pCi	71.9	64.4	1.12	A
	E11917	AP	Ce-141	pCi	80.1	86.3	0.93	A
			Co-58	pCi	110	116	0.95	A
			Co-60	pCi	277	260	1.07	A
			Cr-51	pCi	275	215	1.28	W
			Cs-134	pCi	192	199	0.96	A
			Cs-137	pCi	165	170	0.97	A
			Fe-59	pCi	122	124	0.98	A
			Mn-54	pCi	120	122	0.99	A
			Zn-65	pCi	175	183	0.96	A
	E11918	Water	Fe-55	pCi/L	1630	1630	1.00	A
	E11919	Soil	Ce-141	pCi/g	0.136	0.142	0.96	A
			Co-58	pCi/g	0.179	0.191	0.94	A
			Co-60	pCi/g	0.405	0.429	0.94	A
			Cr-51	pCi/g	0.230	0.355	0.65	N [1]
			Cs-134	pCi/g	0.272	0.328	0.83	A
			Cs-137	pCi/g	0.336	0.356	0.94	A
			Fe-59	pCi/g	0.210	0.205	1.02	A
			Mn-54	pCi/g	0.210	0.201	1.05	A
			Zn-65	pCi/g	0.301	0.301	1.00	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) See NCR 17-16

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
December 2017	E12054	Milk	Sr-89	pCi/L	92.1	92.3	1.00	A
			Sr-90	pCi/L	18.3	16.9	1.09	A
	E12055	Milk	Ce-141	pCi/L	97.8	98.3	0.99	A
			Co-58	pCi/L	92.3	89.9	1.03	A
			Co-60	pCi/L	176	173	1.02	A
			Cr-51	pCi/L	226	242	0.93	A
			Cs-134	pCi/L	118	125	0.95	A
			Cs-137	pCi/L	148	141	1.05	A
			Fe-59	pCi/L	123	113	1.08	A
			I-131	pCi/L	66.0	57.8	1.14	A
			Mn-54	pCi/L	173	161	1.08	A
			Zn-65	pCi/L	233	211	1.10	A
	E12056	Charcoal	I-131	pCi	48.1	47.5	1.01	A
	E12057A	AP	Ce-141	pCi	108	111	0.97	A
			Co-58	pCi	89.5	102	0.88	A
			Co-60	pCi	223	196	1.14	A
			Cr-51	pCi	311	274	1.13	A
			Cs-134	pCi	141	142	1.00	A
			Cs-137	pCi	162	160	1.01	A
			Fe-59	pCi	121	129	0.94	A
			Mn-54	pCi	177	182	0.97	A
			Zn-65	pCi	203	239	0.85	A
	E12058	Water	Fe-55	pCi/L	1970	1740	1.13	A
	E12059	AP	Sr-89	pCi	71.2	87.4	0.81	A
			Sr-90	pCi	12.9	16.0	0.81	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2017	17-MaS36	Soil	Ni-63	Bq/kg	-5.512		*(1)*	A
			Sr-90	Bq/kg	571	624	437 - 811	A
	17-MaW36	Water	Am-241	Bq/L	0.693	0.846	0.592 - 1.100	A
			Ni-63	Bq/L	13.4	12.2	8.5 - 15.9	A
			Pu-238	Bq/L	0.7217	0.703	0.492 - 0.914	A
			Pu-239/240	Bq/L	0.9277	0.934	0.654 - 1.214	A
	17-RdF36	AP	U-234/233	Bq/sample	0.0911	0.104	0.073 - 0.135	A
			U-238	Bq/sample	0.0967	0.107	0.075 - 0.139	A
	17-RdV36	Vegetation	Cs-134	Bq/sample	6.44	6.95	4.87 - 9.04	A
			Cs-137	Bq/sample	4.61	4.60	3.22 - 5.98	A
			Co-57	Bq/sample	-0.0229		*(1)*	A
			Co-60	Bq/sample	8.52	8.75	6.13 - 11.38	A
			Mn-54	Bq/sample	3.30	3.28	2.30 - 4.26	A
			Sr-90	Bq/sample	1.30	1.75	1.23 - 2.28	W
			Zn-65	Bq/sample	5.45	5.39	3.77 - 7.01	A
August 2017	17-MaS37	Soil	Ni-63	Bq/kg	1130	1220	854 - 1586	A
			Sr-90	Bq/kg	296	289	202 - 376	A
	17-MaW37	Water	Am-241	Bq/L	0.838	0.892	0.624 - 1.160	A
			Ni-63	Bq/L	-0.096		*(1)*	A
			Pu-238	Bq/L	0.572	0.603	0.422 - 0.784	A
			Pu-239/240	Bq/L	0.863	0.781	0.547 - 1.015	A
	17-RdF37	AP	U-234/233	Bq/sample	0.103	0.084	0.059 - 0.109	W
			U-238	Bq/sample	0.115	0.087	0.061 - 0.113	N [2]
	17-RdV37	Vegetation	Cs-134	Bq/sample	2.34	2.32	1.62 - 3.02	A
			Cs-137	Bq/sample	0.05		*(1)*	A
			Co-57	Bq/sample	3.32	2.8	2.0 - 3.6	A
			Co-60	Bq/sample	2.09	2.07	1.45 - 2.69	A
			Mn-54	Bq/sample	2.90	2.62	1.83 - 3.41	A
			Sr-90	Bq/sample	1.17	1.23	0.86 - 1.60	A
			Zn-65	Bq/sample	6.07	5.37	3.76 - 6.98	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) See NCR 17-15

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identrification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2017	MRAD-26	AP	GR-A	pCi/sample	76.3	85.5	28.6 - 133	A
April 2017	RAD-109	Water	Ba-133	pCi/L	49.2	49.7	40.8 - 55.1	A
			Cs-134	pCi/L	83.2	90.1	74.0 - 99.1	A
			Cs-137	pCi/L	202	206	185 - 228	A
			Co-60	pCi/L	51.2	54.7	49.2 - 62.7	A
			Zn-65	pCi/L	39.3	53.8	47.2 - 65.9	N [1]
			GR-A	pCi/L	53.6	75.0	39.5 - 92.3	A
			GR-B	pCi/L	42.7	38.5	25.5 - 46.0	A
			U-Nat	pCi/L	50.1	55.6	45.2 - 61.7	A
			H-3	pCi/L	7080	6850	5920 - 7540	A
			Sr-89	pCi/L	40.7	66.2	53.8 - 74.3	N [1]
			Sr-90	pCi/L	26.9	26.7	19.3 - 31.1	A
			I-131	pCi/L	26.7	29.9	24.9 - 34.9	A
September 2017	MRAD-27	AP	GR-A	pCi/sample	40.9	50.1	16.8 - 77.8	A
		AP	GR-B	pCi/sample	58.0	61.8	39.1 - 90.1	A
October 2017	RAD-111	Water	Ba-133	pCi/L	71.3	73.7	61.7 - 81.1	A
			Cs-134	pCi/L	43.0	53.0	42.8 - 58.3	A
			Cs-137	pCi/L	48.2	52.9	47.6 - 61.1	A
			Co-60	pCi/L	69.0	69.5	62.6 - 78.9	A
			Zn-65	pCi/L	335	348	313 - 406	A
			GR-A	pCi/L	32.5	35.6	18.3 - 45.8	A
			GR-B	pCi/L	24.3	25.6	16.0 - 33.6	A
			U-Nat	pCi/L	36.6	37.0	30.0 - 40.9	A
			H-3	pCi/L	6270	6250	5390 - 6880	A
			I-131	pCi/L	26.4	24.2	20.1 - 28.7	A
November 2017	111317O	Water	Sr-89	pCi/L	57.1	50.0	39.4 - 57.5	A
			Sr-90	pCi/L	27.1	41.8	30.8 - 48.0	N [2]

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(1) See NCR 17-09
(2) See NCR 17-19